The Interaction between Park management and the activities of Local People around National Parks in Minas Gerais, Brazil

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ABSTRACT

This study assesses the social impact of the establishment of the National Park of Caparaó and the National Park of Grande Sertão Veredas on their neighbouring communities.

In each National Park different forms of land use were studied: in the National Park of Caparaó the villages of Alto Caparaó, Santa Marta and Pedra Roxa, and in the National Park of Grande Sertão Veredas, the villages of Chapada Gaúcha, Vereda Santa Rita, Carinhanha, Barbatimão, Galdino and Rio Preto and Batista were selected for detailed studies. By the use of a semi structured questionnaire it was possible to identify four basic categories of rural producers: peasants, family farmers, rural producers with medium levels of income, and rural producers with high levels of income. In total, 86 farmers were interviewed and their relationships with the Park were examined.

The issues that the farmers considered to be significant included the manner in which the National Park was created, questions of land exploitation, and their views concerning problems of land tenure, the use of fire by small scale farmers, the possible benefits of having an adjacent Park and problems concerning environmental protection.

The research analyses the way in which National Parks in Minas Gerais were established and the subsequent forms of land tenure which form the key social issues for the neighbouring communities. Of particular importance is the lack of compensation for farmers where the Parks are insufficiently protected against excess grazing, the incursions of subsistence agriculture, fire incidence, illegal extractions, and animal invasions. A policy is necessary, taking account of the socio-economic context. Specific programmes need to be developed to allow the local population to be integrated into the National Park context; such programmes need to find ways of sustaining the livelihoods of local people whilst protecting the historic heritage afforded by the creation of the Parks.

Declaration

I am responsible for composing this dissertation. It represents my own work and where the work of others has been used it is duly acknowledged.

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Glossary

Agregados- peasants without land that live and work temporarily in large farms

Bandeirantes - men that roved Brazil's hinterland from the mid XVI to XVIII century in search of minerals and indigenous slaves

Benzedor spiritual healer

Caboclo- half caste between white and indigenous people

Capixaba-adjective related to people and things from Espírito Santo State

Cerrado - savanna

Campos rupestres- specialized vegetation that grows on rocky mountain tops

Campo limpo - open grassland without scattered shrubs

Campo sujo - open grassland with scattered shrubs

Cerradão - predominantly woody Savannah

Cesto - basket

Comprador de café - coffee dealer

Donatário - people that received Sesmarias on the Colonial period

Esteiras - rustic rug made of palm tree leaf

Festa de Nossa Senhora Aparecida - the most traditional religious party in Brazil on 12 th of October

Folias de Reis - traditional religious party from 24th of December to 6th of January

Gaúcho - Adjective relative to the population from state of Rio Grande do Sul

Gerais - Savannah in Minas Gerais

Geraizeiros - large areas of savannahs in Minas Gerais

Jagunço- hired gunmen

Latifundio - large and unproductive rural property

Latifundiario.- latifundio owner

Melado Sugar cane syrup

Palmito - palm tree heart *Euterpe edulis*

Pau brasil - Brazilian tree *Caesalpinea echinata*

Peneira - sieve

Posseiro – squatter

Rapadura - lump of hard brown sugar

Real (Reais) - Brazilian currency

Terras griladas - grab land

Veredas - typical vegetation of headwaters in savannas

Voto de cabresto - Halter vote

List of Acronyms

BB Banco do Brasil

Bank of Brazil

CPT Comissão Pastoral da Terra

Pastoral Land Comission

CONAMA Conselho Nacional do Meio Ambiente

National Council for Environment

EIA Environmental Impact Assessment

EMATER Empresa Brasileira de Assistência Técnica e Extensão Rural

Brazilian Enterprise of Rural Extension

FUNATURA Fundação Pro Natureza

Foundation Pro Nature

IBAMA Instituto Brasileiro de Meio Ambiente e dos Recursos Naturais Renováveis

Brazilian Institute for Environment and Renewable Natural Resources

IBDF Instituto Brasileiro de Desenvolvimento Florestal

Brazilian Institute for Forestry Development

IBGE Instituto Brasileiro de Geografia e Estatística

Brazilian Institute of Geography and Statistics

IBRA Instituto Brasileiro de Reforma Agrária

Brazilian Institute for Land Reform

IEF Instituto Estadual de Florestas

State Institute of Forest

INCRA Instituto Nacional de Colonização e Reforma Agrária

National Institute of Colonization and Agrarian Reform

INSS Instituto Nacional de Securidade Social

National Institute for Social Security

IPES Instituto de Pesquisa e Estudos Sociais

Institute of Research and Social Studies

IUCN International Union for Conservation of Nature and Natural Resources

MST Movimento dos Sem Terra

Land Less Movement

NEPA nb

NGO Non Governmental Organization

PNMA Programa Nacional do Meio Ambiente

National Programme of Environment

PADSA Programa de Assentamento Dirigido Serra das Araras

Programme of Settlement Serra das Araras

RIOTERCO Comercial Riograndense de Terras e Colonização Limitada

Commercial of Land and Settlement from Rio Grande do Sul Ld.

RURALMINAS Fundação Mineira de Colonização e Desenvolvimento

Foundation of Settlement and Development of Minas Gerais

SEMA Secretaria do Meio Ambiente

Secretary of Environment

WWF World Wildlife Fund

Dedicated to my sons Thiago and Thomaz

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INTRODUCTION

At present, there are 35 National Parks in an area of 9742186 ha (see Table and Map). In spite of the extensive area of coverage most of them face the same problems of land tenure, lack of management, lack of personnel and lack of programmes to support local people that live in and around these National Parks. This situation has left the national parks vulnerable to invasion, poaching, deforestation, illegal agriculture, and livestock exploitation, pollution of watercourses and soil, disorganised tourism, mining and fires.

AMEND (1992) has indicated that around 80% of Brazilian National Parks have surrounding human communities which are utilising the natural resources. According to KANIAK & SCHENKEL (1995), land tenure has become the main issue facing the protected areas of Brazil, taking into account that State ownership has been established in only 20% of this area. This has become one of the most crucial issues for the effective management of these units, since enormous financial resources are required for its resolution. Also, there have been long time lapses between the creation of the protected area and the acquisition of the land, making regulation more difficult due to the revaluation of prices.

The multiple objectives of research, environmental education and conservation of natural resources highlight the importance of National Parks. MACHILIS & TICHNEL (1985), QUINTÃO(1983) AND WETTEBERGH (1987) have suggested that the problems originate from the time when the parks were established. JORGE (1976) went further and suggested that the Brazilian National Parks should be named

National Parks in Brazil

Adapted from IBAMA1995

NATIONAL PARK	U. F.	AREA(ha)	Year of creation
National Park of Pico da Neblina	AM	2200000	1979
National Park of Jaú	AM	2272000	1980
National Park of Amazônia	AM/PA	994000	1974
National Park of Monte Roraima	RR	116000	1989
National Park of Pacaás Novos	RO	765801	1979
National Park of Serra do Divisor	AC	605000	1989
National Park of Cabo Orange	AP	619000	1980
National Park of Araguaia	TO	562000	1959
National Park of Lençóis Maranhanses	MA	155000	1981
National Park of Serra da Capivara	PI	979333	1979
National Park of Sete Cidades	PI	6221	1961
National Park of Marinho Fernando de Noronha	PE	11270	1988
National Park of Ubajara	CE	563	1959
National Park of Marinho dos Abrolhos	BA	91300	1985
National Park of Chapada Diamantina	BA	152000	1961
National Park of Monte Pascoal	BA	22500	1961
National Park of Emas	GO	131868	1961
National Park of Chapada dos Veadeiros	GO	60000	1961
National Park of Brasília	DF	28000	1961
National Park of Pantanal Mato Grossense	MT	135000	1981
National Park of Chapada dos Guimarães	MT	33000	1985
National Park of Caparaó	MG/ES	26000	1961
National Park of Serra da Canastra	MG	71525	1972
National Park of Serra do Cipó	MG	33800	1984
National Park of Grande Sertão Veredas	MG	84000	1989
National Park of Serra dos Órgãos	RJ	11800	1939
National Park of Tijuca	RJ	3200	1961
National Park of Itatiaia	RJ/MG	30000	1937
National Park of Serra da Bocaína	RJ/ SP	100000	1971
National Park of Superagui	PR	21700	1989
National Park of Iguaçú	PR	185262	1939
National Park of São Joaquim	SC	49300	1961
National Park of Aparados da Serra	RS	10250	1959
National Park of Serra Geral	RS/SC	18000	1992
National Park of Lagoa doPeixe	RS	34400	1986

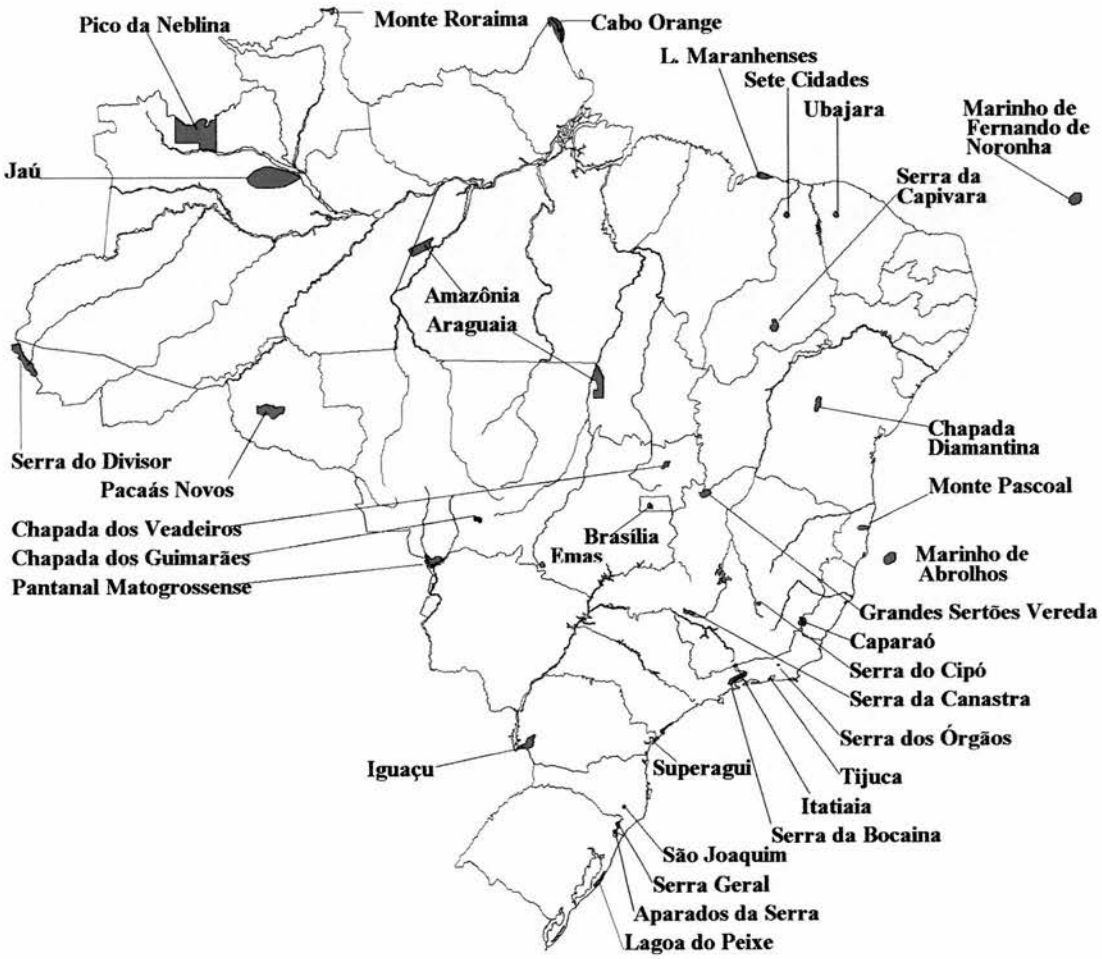

Figure 1.1. Geographical situation of the 35 Brazilian National Parks in 1995.

"Paper Parks", due to the fact that most of them only exist as the Federal Decree that created them.

WEIDMAN (1995) has assessed the current situation. She indicated that the creation of a National Park should not be imposed by the authorities on the human population living their lives in and around the region. She also suggested the need to involve the local population in the establishment and management of the national parks. At the present there are few programmes of development that address the needs and concerns of settlements around the National Parks. Although the rural producers are not uniquely responsible for the human interference to the ecosystems protected by the National parks, it is important to understand the impact that they can have, and the impact the national park has on the system of production adopted by rural producers.

The main objective of this thesis is to comprehend the social impact, caused by the creation of a National Park on the population living around the National Parks of Caparaó and Grande Sertão Veredas in Minas Gerais.

This thesis comprises 8 chapters. The following chapter provides a review of the National, International and Brazilian contexts. Chapter two comprises the methods of environmental impact assessment, social stratification and methods for qualitative analysis. Chapter three provides a discussion on the environmental impact assessment of the National Parks of Minas Gerais and comprises the disturbances of human activities on the components of ecosystems such as water, air, soil, wildlife, vegetation, scenic resources, culture, and socio-economic resources.

Chapters four and chapter five describe respectively the land uses , the socio-economic characterisation of rural producers and social impact of the establishment

of the Park on the communities around the National Park of Caparaó. Chapters six and seven deal with the socio-economic categories of rural producers and the influence of the National Park on the system of production in the villages around the National Park of Grande Sertão Veredas.

Finally, Chapter eight provides the main conclusions to the study.

CHAPTER 1

Evolution of the of National Parks Concepts

This chapter examines the evolution of the concept of National Parks. An historical approach is used to stress the most significant events relating to National Parks in different countries. Initially, the focus is on the evolution of conservation concepts, before analysing the establishment and present situation of National parks in Brazil.

1.1 Evolution of Environmental Conservation Concepts

The roots of environmentalism can be traced to early development of *Homo sapiens* in the beginning of the Pleistocene when the language, stone tools and control of fire probably distinguished mankind from other primates. The population was small and lived by gathering nuts, seeds and plants, supplementing their diet with animals killed by other predators or hunted by themselves. In order to obtain the necessary subsistence, gathering and hunting groups depended on a profound knowledge of their environment. They needed to know well the areas where they lived and what type of food was available in different places and in different seasons of the year. For thousands of years this was the only way for the human population to extract the necessary subsistence from the environment (PONTING, 1991).

In South Western Iran archaeological excavations found bones of gazelle and other wild animals along with those of domesticated forms. For some time around 7500 BC the villagers had apparently ceased to depend solely on hunting. It was presumably at about this stage of population growth and settlement that wild game stocks began to be sustainable only in more remote areas, or under strict protection and preservation in favour of the few for whom the necessity of conservation would be inescapable. The condition compelling a choice between local extinction of game through such pressure and the creation of effective game reserves and protective laws seems to have first emerged in Iran around 5000BC (NICHOLSON, 1970).

The establishment of agriculture marked the most important transition in human history and caused major alterations to the ecosystems. Agriculture was established initially in South-western China and Mesoamerica and by 2000BC included all the major crops and animals systems. However, the crops that could be cultivated and the animals that could be domesticated in each region were determined by the environmental conditions (PONTING, 1992).

Techniques were developed in Southwest Asia that permitted food production although the environment was fairly inhospitable. The Sumerians developed a system of artificial irrigation and water storage that permitted crop production in spite of dry conditions. In Mesopotamia, in the Asyrian and Babylonian regions, the concept of a Park and the practice of planting stands of tree were the first on record (NICHOLSON, 1970).

Similar and independent development occurred in Egypt, adapting to the local conditions determined mainly by the long, narrow and fertile Nile Valley that provided better conditions for agriculture than Mesopotamia. The stability of the

Egyptian agricultural system was maintained essentially by the flood regime of the Nile river. At Karnak in 1500 BC, Thutmosis III of Egypt recorded animals and plants which he had brought back from his Syrian conquest. He already had a menagerie including lions, apes and giraffes and from the same period date the earliest known plant gardens. These gardens, despite being in an arid region, had plentiful water often supplied artificially.

Agropastoralism also moved from Southwest Asia to Europe. The adoption of agriculture by Mediterranean's had fewer problems because the climate resembled that of South West Asia Thus, between 6000-5000BC, Greece and the Balkans saw a shift from subsistence to surplus agriculture, despite the fact that approximately 85% of the Greek territory was then unsuitable. The problem was resolved using techniques of soil conservation, such as manure to maintain the fertility and structure of the soil and the construction of terracing for controlling erosion on hillsides. In 590BC Solon suggested that cultivation on slopes should be banned due to the amount of soil lost (PONTING, 1992). The concept of "providential ecology" in which nature is designed to benefit and preserve each species was implicit in writings of Herodotus and Plato (KREBS, 1985). For the Greeks, ecological harmony was the guiding principle for the understanding of nature.

In Italy, the Roman civilisation established after the 4th century BC, started a gradual change in agriculture. Initially, the fertile soils near the mouth of the Tibia in central Italy were drained and used for intensive agriculture, but the creation of the Roman Empire also increased the pressure on the environment in other Mediterranean areas. The rise of Christianity and its adoption as the State religion by the late Roman Empire in the 4th century introduced the Jewish vision of a God who

often punishes mankind with natural disasters, like the great flood or the swarms of locusts. Exodus (7:14-12:30) describes the plagues that God called upon Egyptians (KREBS, 1985). The most important text adopted by Christians about God-Man-Nature relationship is Genesis I in which the dualism between man and nature was established and allowed man to exploit nature for his own ends (O'CONNOR, 1974).

The medieval thinkers accepted the Jewish vision of God giving rights to humans to exploit plants, animals and the whole world for their benefit. Thomas Aquino reinforced those ideas, incorporating the classical view of Aristotle about nature being more coherent and logical under men's rule. However, this medieval perspective was contested by St Francis who viewed all creatures as equal parts of creation and not for utilitarian purposes (WHITE, 1990).

Maintenance of habitat for fauna was of great significance in the Middle Ages. This was due to hunting being one of the most important noble activities and despite its elitist character, was a form of ecosystem protection. The Normans developed a system of forest management, establishing "royal forests" and "lands for sports", which absorbed some 5 million acres (out of 37 million) in England and Wales (NICHOLSON, 1970).

A remarkable transformation across the world began with the European expansion, commencing in 1500 when the Portuguese and Spaniards conquered Central and South America, followed by the British and French occupation of North America. The arrival of Europeans in the Americas was a complete disaster for native people, as many indigenous societies disintegrated under European pressure. Despite differences in approach, the attitudes of Europeans toward native people were similar - land, people and resources were to be exploited. The adoption of slave

labour, systems of plantation and *latifundios* introduced by the Portuguese and Spaniards brought enormous environmental and social disturbance to the whole of Latin America. In the southern United States the issue of disturbance had also arisen as both areas were great exporters for the European market (PONTING, 1991). Despite the great environmental disturbance caused by the model of colonialism adopted by the Portuguese in Brazil, they introduced the first law for protecting natural resources in America. In 1605 "The rules of pau-brasil" established a forest code for timber exploitation.

The Industrial Revolution involved a large number of alterations to many political, cultural, economic, social and environmental contexts. This was linked to the process of capital accumulation and market expansion established with colonialism (FRANK, 1978). Agriculture in the colonies became more specialised to supply the demand for raw material in the European industry. The resulting environmental impact was not restricted to the colonies but also brought serious problems to the European industrialised countries. In Britain, the impact of industrialisation and intensive urbanisation led to the creation of legislation for timber protection in the eighteenth century, which became some of the earliest conservation legislation (NICHOLSON, 1970).

The last century saw the replacement of Jewish-Christian visions about man-nature relationships by capitalist premises. The theories of classical economics, contained in works such as those of Smith, Ricardo and Mill, centred on the means of production (land, labour and capital) and how they were articulated. The assumptions of classical economics disregarded the depletion of natural resources, treating the earth's resources as capital, a set of assets to be turned into a source of profit. Fauna,

flora, minerals, water, and soil were treated like marketable commodities to be sold or exploited with the cost of extraction determining the price (PONTING, 1991). These ideas allied to increasing industrial development, led to enormous advances in the means of exploiting natural resources. The cornucopia view that the bounty of natural resources had no limits became almost universal (McEVANS, 1983). The United States, in particular, was seen as depending on the opening up and on bringing into use the vast continental natural resources and the expansion of the economy brought all kind of abuses to various ecosystems. Inevitably, American society began in time to manifest concerns about the situation.

1.2 National Parks concepts

The publication of **Man and Nature** by George Perkins Marsh in 1864 established a new ecological perspective. He held the view that man must live with nature and not endanger any form of life, and he initiated an intense discussion about environmentalism in American Society. The movement encountered a large number of allies among the American intellectuals in the search for a cultural identity, and they incorporated conservationist values to reinforce their convictions about America's national values. The cult of nature as a proof of American national greatness had begun just after independence, with the intellectuals trying to reinforce the view of the United States destination toward a grandiose and glorious future despite the lack of a long artistic and literary heritage. The discovery of the Yosemite Valley and Sierra redwoods, in 1851 and 1852 respectively, showed real evidence

that the United States had a valid claim to cultural recognition through the legacy of outstanding scenery (RUNTE, 1987).

For the first time Americans argued with confidence that the United States had something of value to contribute to world culture. Although European monuments could never be eclipsed, the United States had "earth monuments"; the natural marvels of the west compensating for America's lack of old cities and aristocratic traditions. The movement toward the creation of a National Park was initiated in the winter of 1864. A small group of nationalists persuaded the Senator John Conness to propose legislation protecting both Yosemite and Sierra redwoods from private misuse, and establishing them for "public use, resort, and recreation." Congress was receptive to the proposals and in June of 1864, President Abraham Lincoln signed the bill into law. The recreational objective determined that only a small area of land was to be protected consequently ignoring the ecological value of the region. Thus monumentalism and not environmentalism was the driving force behind the 1864 Yosemite Act (RUNTE, 1987).

In 1860, gold was discovered in Montana Territory and this led to the permanent exposure of the Yellowstone region, as goldmines invaded the territory via the Yellowstone River. Occasionally news spread of "strikes" in areas of spectacular scenery and natural phenomena and thus adventurers began to organise expeditions to explore the mythical Yellowstone. This situation led the American Congress to address a sum of US$40000 in order to accomplish a survey of the region that would produce far more than another description of Yellowstone's natural phenomena. The group included entomologists, topographers, a zoologist, a mineralogist, a meteorologist, and a physician Thomas Morran, the artist and Henry

Jackson a frontier photographer were also invited to provide all important visual records of the expedition discoveries. The results of their work provided the basis for the creation of the Yellowstone National Park (RUNTE, 1979).

Monumentalist principles had been used to protect the Yosemite Valley and Sierra Redwood regions and in 1872 were applied to create the Yellowstone National Park. There were differences between the two regions, as Yellowstone was founded upon aesthetic and scientific values and was a genuine National Park since the Federal Government retained exclusive jurisdiction over the area. In addition, Yellowstone was much larger than Yosemite Valley and was the first to be called National Park, again reflecting the ideas and anxieties of 1864. It was not until 1930 that part of the Florida Everglades was designated as the first "wilderness" National Park (RUNTE, 1979). Despite the conflict of aims involved, the ideas of Muir, Olmsted and other American pioneers had spread all over the world, and have undergone a long process of evolution (McEWEN, 1982). John Muir was the most important conservationist of his time. According to DIEGUES (1994), John Muir considered animals, but plants and even rocks were part of the Divinity present in nature.

The Yellowstone Park formed a model for national parks across the world, stressing the use as wilderness preserves for public recreation without permanent human occupation or extractive use. Australia's Royal National Park in 1879, Canada's Banff National Park in 1885, and Kruger National Park in South Africa followed the establishment of Yellowstone in 1898. In 1885 a civil movement in England, namely the National Trust for Places of Historic Interest or Natural Beauty, had acquired open spaces and sites of historical or natural interest for preservation.

Thus, by the turn of the 20th century, National Parks and similar reserves had been established in several countries (QUINTÃO, 1983). The principal aim of these areas was nature protection; the impact on the human population was not the major concern, consequently becoming a paradox of the National Park system.

The first European countries to create National Parks were Sweden and Switzerland. In 1914 Switzerland established a National Park for scientific purposes, creating and keeping a field laboratory in the Alps where research on fauna and flora could be accomplished for long periods under unaltered environmental conditions, and avoiding the effects of human activity. In addition Russia created two big reserves: Burguzin and Kedrovaya Pad in 1916. They were followed by the Astrakan in 1919 and Lenin in 1920 (QUINTÃO, 1983). National Parks were not established in South America until 1922, when a national park in Argentina was created.

The concept of a national park formed the overall principle for the designated areas, rather than the management objectives, which differed for each area. Thus it was deemed necessary to find a definition of aims for National Parks. The 1933 "Conference for Conservation of Fauna and Flora" held in London, defined the management aims for National Parks in African countries as:

"(a) Placed in public control, the borders of which shall not be altered or any portion be capable of alienation except by competent authority.

(b) Set aside for the propagation, protection and preservation of wild animal life and wild vegetation and for preservation of objects of aesthetic, geologic, prehistoric, historical, archaeological and other scientific interest for the benefit, advantage and enjoyment of the general public.

(c) The hunting, killing or capturing of fauna and the destruction or collection of fauna is prohibited except by the direction and control of the park authorities."(QUINTÃO, 1983).

In May 1940, the collective experience of National Parks in American countries established the American Union with a committee of expertise to draw up the "Pan-American Convention on Nature Protection and Wildlife Preservation the Western Hemisphere". This treaty was signed by all nations with the exception of Panama, Honduras and Paraguay. The Convention established the basic pattern for a scheme of Parks and protected reserves throughout the Americas and defined National Parks as:

> *"The expression National Park shall denote areas established for the protection and preservation of superlative scenery, flora and fauna of National significance, which the general public may enjoy and from which it may benefit when placed under public control"*(QUINTÃO, 1983).

Under the terms of the convention the expression National Park, Natural Reserve Nature Monument and Strict Wilderness Reserves were defined. Moreover the experts were very conscious of the importance of Parks for ecological studies (COOLIDGE, 1972). The movement to create National Parks in South America was also intense at this time. In 1942 six National Parks were established in Argentina, three in Brazil, six in Chile, thirteen in Mexico and one in each of Dominican Republic, Ecuador and Venezuela.

Another important event was the creation of the International Union for the Protection of the Nature. This was established at Fountainbleau in 1948 by agreement between Governmental and non-governmental agencies (the name has since been changed to International Union for the Conservation of Nature). It was

also decided in 1958 to set up an International Commission for National Parks and Protected Areas(CNPPA)(HARROY,1972). By this time the National Park concept had gained in importance:

> *"National Parks contribute to the inspiration, culture and welfare of mankind and are available for economic and scientific reasons as areas for the future preservation of fauna, flora and geological structure in their natural state"* (PACKARD,1972).

At the 1959 Economic Social Council Meeting of the United Nations (ECOSOC), in Mexico City, a resolution was adopted to establish a United Nation's list of National Parks and Equivalent Reserves. The establishment of this list crystallised the need for the clear understanding of the terms of reference, particularly the definition of National Parks, and how to identify other categories of lands set aside to preserve natural resources. The purpose of the list was to encourage nations to safeguard their natural resources and wildlife, and to guard and improve their National Parks and reserve systems. It also hoped to invoke the prestige of the United Nations on such issues. The criteria by which an area would be judged acceptable for the UN list reflect precise standards and stress 3 basic values:

1- legal basis for sufficiently strict protection

2- reasonable minimum size

3- an adequate staff and budget to provide effective management.

The First World Conference on National Parks in 1962 adopted a resolution that gave considerable impetus to the establishment of Marine Park Sanctuaries around the world and recommended the extension of existing land parks to include adding underwater areas. Further priority areas included the establishment of protected areas for safeguarding representative ecosystems, and maintaining the

integrity of existing National Parks, hence safeguarding plants, animals, biotic communities, geomorphologic sites and habitats of special scientific interest, as well as landscapes of great beauty.

The 10th General Assembly of the IUCN in New Delhi in 1969, further verified the meaning of the term national park. The IUCN stated that "considering the increasing use of the term National Park to design areas with different status and objectives recommends the use of the term National Park to areas answering to following characteristics:

"A National Park is a relative large area

1. *Where one or several ecosystems are not materially altered by human exploitation and occupation, where plant and animal species, geomorphologic sites and habitat are of special scientific, educative and recreate interest or which contains a natural landscape of great beauty and*

2. *Where the highest competent authority of the country has taken steps to prevent or to eliminate as soon as possible exploitation or occupation in the whole area and to enforce effectively the respect of ecological, geomorphologic aesthetic features which have led to its establishment and*

3. *Where visitors are allowed to enter, under special conditions, for inspirational, educational, cultural and recreational purposes.*

Governments are accordingly requested not to designate as a National Park:

1. *A scientific reserve which can be entered only by special permission (strict nature reserve)*

2. *A natural reserve managed by a private institution or a lower authority without some type of recognition and control by the highest competent authority of the country,*

3. *A "special reserve" as defined in the African Convention of 1968 (fauna or flora reserve, game, bird sanctuary, geological or forest reserve, etc.)*

4. *An inhabited and exploited landscape with planning and measures taken for the development of tourism which have led to the setting up of the "recreation areas," where industrialisation and urbanisation are controlled and where public outdoor recreation takes priority over the conservation of ecosystems (parc naturel règionale, nature park, Naturpark, etc)*

The Second World Conference on National Parks in 1972 met at Great Teton National Park in Wyoming, United States The meeting was dominated by Americans and Europeans and focussed on the traditional concerns of National Parks such as the preservation of natural landscapes and their use for recreational and educational purposes. The conference recommended as a priority the establishment of reserves in regions of tropical forest, the North and South Poles and marine ecosystems and the need for International and World parks. The conference also deemed important the necessity of adopting the definition for a National Park determined by the 10th General Assembly with the application of classical techniques of management (Second World Conference in National Parks, 1972).

In 1978 IUCN established ten categories of protected areas based on the objectives of management - table 1.1.

Table 1.1Categories of Protected Areas established by IUCN 1978

Category	Definition
I-Strict Nature Reserve	To protect nature and maintain natural process in an undisturbed state in order to select ecologically representative examples of the environment available for scientific study, environmental monitoring, and education and for maintenance of genetic resources a dynamic and evolutionary state.
II-National Park	To protect outstanding natural and scenic areas of national or international significance for scientific, educational, and recreational use These are relatively large natural areas not materially altered by human activities where extractive resources uses are not allowed.
III-Natural monument natural landmark	To protect and preserve nationally significant natural features because of their special interest or unique characteristics These are relatively small areas focused on protection of specifics features
IV-Managed nature reserve/wildlife sanctuary	To ensure the natural conditions necessary to protect nationally significant species, groups of species, biotic communities or physical features of the environment where these may require specific human manipulation for their perpetration Controlled harvesting of some resources can be permitted.
V-Protected landscape or seascape	To maintain nationally significant natural landscapes that are characteristic of the harmonious interaction of man and land while providing opportunities for public enjoyment throughout recreation and tourism within the normal life-style and economic activity of these areas These are mixed cultural and natural landscapes of high scenic value where traditional land uses are maintained.
VI-Resources reserves	To protect the natural resources of the area for the future use and prevent or certain development activities that could affect the resource, pending the establishment of objectives based upon appropriate knowledge and planning This is a "holding" category, used until a permanent classification can be determined.
VII-Anthropological reserves / natural biotic area.	To allow the way of life of societies living in harmony with environment to continue undisturbed by modern technology This category is appropriate where resource extraction by indigenous people if conducted in traditional manner.
VIII-Multiple use management area / managed resource area	To provide for sustained production of water, timber, wildlife, pasture, and tourism, with the conservation of nature primarily oriented to the support of the economic activities(although specific zones may also be designed within these areas to achieve specific conservation objectives).
Biosphere reserve	To conserve for present and future use the diversity and integrity of biotic communities of plants and animals within natural ecosystems and safeguard the genetic diversity of species on which their continuing evolution depends These are internationally designated sites managed for research, education, and training.
World Heritage site	To protect the natural features for which the area is considered to be of outstanding universal significance This is a select list of the world's unique natural and cultural sites nomined by countries that are parties to the World Heritage Convention.

In the ten years between the second and third international congresses on national parks, major changes occurred in the world with the energy crisis, the new economic and social order and the continuing demographic explosion. These changes marked a new approach towards the environment with the IUCN attending these new perspectives adopting the World Conservation Strategy in 1980. This strategy made clear that protected areas are essential for conservation (and hence for sustainable development). It devoted attention to four problems concerning the establishment and management of protected areas: the lack of coverage, lack of knowledge, lack of integration and lack of security. The World Conservation Strategy also stressed the necessity of redistributing the costs and benefits of protected areas to local communities, derived from tourism and projects of sustainable development. The World Conservation Strategy emphasised that such a development is essential to conservation (ALLEN, 1980).

From 1972, considerable progress was made in the establishment of protected areas. Between 1972 and 1982 the number of areas rose from 1584 to 2307 and the area increased from 212 to 386 million hectares. In 1982, there were 2611 Protected Areas in 124 countries on the United States list of National Parks and Equivalent Reserves (PACKARD,1982).

The World National Park Congress (previously The World Conference on National Parks) occurred in Bali, Indonesia in 1982 and spread the concept of "Parks for Sustainable Development". The Congress emphasised the possibility of linking conservation and sustainable development and the rational use of natural resources, and revealed a growing influence from professionals of developing countries.

The Bali Congress recommendations were divided over the management of protected areas: the traditional recommendations derived from American environmentalism, whereas the new approach was linked to sustainable development. This approach, integrating National Parks within the socio-economic context, had been recommended by the IUCN as being able to safeguard ecosystems in National Parks and promote sustainable development.

The Bali Congress began questioning the largely romantic view of parks as protected paradise, thus the purely preservationist approach, where Parks were considered "fortresses", began to encounter opposition. This view was replaced by the idea that the only way to safeguard ecosystems, protected by National Parks, was to integrate the parks within the regional socio-economic system, along with multiple uses for individual parks (MACHLIS&TCHNELL,1985). There was increasing emphasis on the link between economic activities and environmental conservation throughout the 1980s. Authors such as TICHNELL et al (1983), MACHLIS & TICHNELL (1987), NEUMAN &MACHILIS (1989) suggested that the type and intensity of threats to Parks are influenced by the socio-economic characteristics of the region where Park is located.

The last part of this century has experienced excessive environmental degradation and enormous transformation in ecology, economic and policy resulting in greater impetus for the protection of natural resources. Between 1982 and 1992, 1778 new protected areas were designated covering 142 million of hectares. In this context, the environment issue allied to the social sciences, became an important tool utilised in the management of protected areas. Many studies, such as those of WEBER (1985), and JOHANES (1982); COLIN (1990), DANG (1991), suggested

that the involvement of local people was extremely beneficial in protected area management, preserving the cultural heritage, and acting to reduce outside human interference on protected resources.

The IV World Congress on National Parks and Protected Areas, Caracas, Venezuela in 1992, focussed on Parks for Life. Following the Bali Congress, there was greater participation from managers of protected areas in developing countries, which focussed on the relationship between protected areas and local people. The Caracas Congress recommendations stressed the necessity of consolidating and enlarging national systems of well managed protected areas. This would ensure that environmental and economic benefits provided by protected areas are recognised in National development strategies and furthermore safeguard the traditions and interests of local people. Moreover industry (including tourism, agriculture, forestry, extraction of oils and minerals) must also adopt the highest standards of environmental protection and eliminate damaging impacts on protected areas. In addition, it was recognised that action to safeguard the living riches and natural beauty of the Earth depends on the commitment of all people, and emphasised that the establishment and maintenance of protected areas is essential to sustaining human society and conserving global biological diversity (IUCN, 1992).

As consequence of the IV World Congress, the designated categories for protected areas were modified. Since 1988, the IUCN categories from 1978 had been the subject of a lengthy review by the Commission on National Parks and Protected Areas (CNPPA) and culminated in a workshop at the Caracas Congress (IUCN, 1995). The new categories were adopted to fulfil the concepts towards protected

areas developed at the Caracas congress, and were thus based on the reality of the management strategies. The new modified categories of protected areas are:

Table 1.2 Categories of Protected areas established by IUCN 1994

Categories of Protected areas	Definition
I – Strict Nature Reserve / Wilderness area	Areas of land or sea possessing some outstanding or representative ecosystem, geological or physiological features and or species available primarily for scientific research and or environmental monitoring; or large areas of unmodified or slightly modified land and or sea retaining their natural character and influence, without permanent or significant habitation, which are protected and managed so as to preserve their natural conditions.
II –National Park-	Protected area managed mainly for ecosystem conservation and recreation Natural areas of land or sea designated to (a) protect the ecological integrity of one or more ecosystems for this and future generations (b) exclude exploitation or occupation inimical to the purposes of designations of the area and (c) provide a foundation for spiritual, scientific, educational, recreational, and visitor opportunities, all of which must be environmentally and culturally compatible.
III- Natural Monuments-	Protected areas managed mainly for conservation of specific features Areas containing one or more specific natural or natural/cultural features which are of outstanding or unique value because of their inherent rarity representative or aesthetic qualities or cultural significance.
IV- Habitat Species Management Area-	Protected area managed mainly through management intervention Areas of land or and sea subject to active intervention for management for proposes so as to ensure the maintenance of habitats and or to meet the requirement of specific species.
V- Protected Landscape / Seascape	Protected area managed mainly for landscape /seascape conservation and recreation Areas of land, with coast and sea as appropriate where, the interaction of people and nature over time has produced an area of distinct character with significant aesthetic, cultural and or ecological value and often with high ecological diversity Safeguarding the integrity of this traditional interaction is vital to the protection, maintenance and evolution of such area.
VI- Managed Resource Protected Area	Protected areas managed mainly for the sustainable use of natural ecosystems Areas containing predominantly unmodified natural systems, managed to ensure long term protection and maintenance of biological diversity, while providing at the same time a sustainable flow of natural products and services that meet community needs

The 1994 classification system contained only six categories, and introduced "managed resource protected areas" as number VI, and modified category I to

encompass wilderness areas. An important component of the system, was the inclusion of indigenous settlements in all categories of protected areas. This is particularly significant to categories I and II, Strict Nature Reserves and National Parks respectively, which previously discouraged settlements. The new categories of protected areas represent the major reformulation of protection goals, and provides a basis for restoring land to people previously excluded by earlier National Parks ideals.

Since IV Congress on National Parks, the relationship between people that live adjacent to protected areas and the management has been transformed as different aspects of the management have been questioned. Many authors such as EATON (1992), DRIJVER (1992), STEVENS & SHERPA (1993), RODRIGUES (1992), SALINAS (1992), MKANDA & MUNTAHALI (1994), stressed the necessity of the involvement of the local population in the long-term management. Additionally, the importance of attending to the needs of these communities has been realised as the only effective management for the protection of the natural resource.

1.3 Environmental Conservation in Brazil

Before the arrival of the Europeans, Brazil was inhabited by indigenous people who utilised natural resources for their means of livelihood. The arrival of Europeans altered the relationship between people and the natural resources, to attend to the increasingly important needs of the European market.

Since the beginning of the 16th century, the Brazilian seaboard was exploited by the Portuguese and French in search of the plant species ***Caesalpinea echinata***, the *Pau brasil. Pau brasil* was used for the colouring in textiles, but due to this demand nearly became extinct. The rudimentary exploitation system adopted by the Portuguese and French led to the destruction of large areas of Atlantic forest, and brought about massive environmental alterations. As more and more of the natural resources were discovered the process of exploitation further intensified, and new lands were occupied.

Despite the environmental disturbance caused by the model of colonialism adopted by the Portuguese in Brazil, the first law protecting natural resources in America was introduced in 1605 "The rules of pau-brasil", were a forest code for timber exploitation and established modes of tree cutting to permit the growing of trees, and forbidding the burning of vegetation (PEREIRA, 1983). The code also created a forest guard and established punishment for breaking the rules of the code.

The European demand for sugar cane led to its replacement as principal export, over *pau brazil* Sugar cane is very demanding on the land and requires

extensive areas for cultivation and thus eventually replaced richly vegetated areas with poor soils and eroded lands. Fire was used to clear land for the canefields, devastating the flora along with the fauna: deer, wild boar, tapir, rabbit, pacas and armadillo disappeared. The system of production was based on latifundios, plantations and slave labour and brought intense alterations to the socio-economic system and landscape particularly of North-eastern Brazil (GALEANO, 1979). The continuing destruction of the natural resources, to attend to the needs of external markets, led the Portuguese Monarch to declare the necessity of preserving the forest in Brazil (QUINTÃO, 1983).

The continued expansion of the world market caused further intensification of the land use. Cotton was originally used by the indigenous people, but with the expansion of colonialism its use was intensified becoming a popular fibre for spinning and weaving into clothes (PRADO JR, 1945). The requirement for cotton greatly increased with the Industrial Revolution in Britain in the late 18th century The development of the spinning frame invented by Arkwright at the same time that Watt was patenting the steam engine and Cartwright was developing the mechanical loom gave textile manufacturing a definitive impulse, and led to the expansion of the cotton plantations in Brazil. Consequently large areas of North (Maranhão) and Central (Goiás) Brazil were deforested to produce cotton in order to supply external markets and maintain the colonial system (GALEANO, 1970).

Coffee crops were introduced during the first half part of the last century to Rio de Janeiro state, spreading towards São Paulo in the search for virgin lands. Towards the end of the century, the Paraiba river valley became the richest area of the country, but was quickly ruined by the form of plant cultivation that left forests

razed and natural reserves exhausted. Previously virgin land became eroded with the continual westward expansion of coffee growing, finally reaching the banks of the Parana where, facing the Mato Grosso do Sul savannahs, the expansion turned south (GALEANO, 1970).

The intense exploitation in certain areas of Brazil led to a need to safeguard the natural resources through the establishment of protected areas. The idea was based on the American experience and was conceived by André Rebouças in 1876. He suggested the establishment of National Parks in Sete Quedas and Ilha de Bananal (MILANO, 1993).

After 421 years of inadequate land management, the Brazilian Forest Service was established in 1921. However, the Brazilian Forest Service was restricted to certain areas and did not attend to the real necessities of the country. In 1934, it instituted the Forest Code coinciding with the First Conference on Nature Conservation in Brazil. At this time the Brazilian Constitution affirmed that it was the obligation of the State to protect the scenic beauty as monuments of historical or artistic value.

Under the new constitution of 1937, the Decree Law number 25 'Design Natural Monument' designated sites or landscape which should be conserved and protected because of their notable natural manmade features. Also, in 1937, the first national Park in Brazil was established. This was the National Park of Itatiaia and its creation emphasised the primary importance of the scientific character of the area, with the tourist demand only being a secondary aim. The creation of this park utilised article 9 of the Brazilian Forest Code, approved by Decree 23793 in 1934, defining National Parks as:

Natural Public Monuments to perpetuate in its floristic composition primitive patches of the country that deserve protection due to their peculiarity

According to QUINTÃO (1983), there were four main phases in the process of the establishment of National Parks in Brazil. The first phase occurred in southeastern and southern Brazil, beginning with the creation of the National Park of Itatiaia. These areas were of great environmental significance, due to the pressure from the high population density and the advanced stage of development. The process of establishment was facilitated by the information available on the natural resources of the region, due to their accessibility. The process was not so easy in the more inaccessible areas of Brazil, but from 1940, more parks were established with the continued westward migration, and, in 1960, with the creation of Brasília.

The Convention for Flora, Fauna and Scenic Beauty for the Countries of America, in Washington 1940, led to further developments in the attempts to conserve natural resources. The Pan-American Convention defined National Parks as areas established for the protection and conservation of scenic beauty, fauna and flora of national importance, for public enjoyment and government responsibility. It was not until 1948 that Brazil accepted Government responsibility for Protection of Natural Areas, as part of the Convention.

The next 40 years saw continuing evolution in Brazil's approach towards the environment. The first phase of military dictatorship, between 1964 and 1970, established the Forestry Code (law number 4771). This law provided for the protection of all existing forest and all forms of vegetation, and made provision for the creation of National Parks, ecological reserves and forest reserves. Additionally, the Institute of Forestry Development was created - Instituto Brasileiro de

Desenvolvimento Florestal (IBDF) under the Ministry of Agriculture and was responsible for the country's national forests, biological reserves and National Parks.

The second phase of military government was from 1971-1985 and it was under this regime that the ecological movement gained empowerment. In 1979 the Federal Decree number 84017 provided a definition for Municipal, State and a National Parks. In this Decree, National Park was defined as:

> *Extensive and defined geographical areas with exceptional natural attributes permanently protected Destined for scientific, cultural, educational, and recreational purposes and created and administrated by federal government. Constitute the wealth of the Union destined for the use of the people and should be preserved and maintained untouched by the authorities. The main objective is the preservation of the ecosystems from any modification*

Despite the constant reappraisal of environmental policies and awareness, the environmental degradation continued. The New Republic (1985-1990) therefore established the Brazilian Institute for Environment and Renewable Natural Resources – IBAMA (law 7735) IBAMA firstly replaced the Institute of Forestry Development, created under the Ministry of Agriculture in 1967, and responsible for the national forests, biological reserves and national parks. Secondly, IBAMA took over from the Special Environmental Secretary (SEMA) which was created by the Ministry of the Interior to manage ecological stations, ecological reserves and environmental protection areas. According to the IUCN (1994), some of the issues of the management of protected areas were solved with the creation of IBAMA, with protected areas being managed at a national level, instead of by separate bodies under separate ministries.

1.4 Present situation of protected areas and National Parks in Brazil

At present Brazil has 160717773 hectares of private, municipal, state and federal protected areas, Fig 1.1.

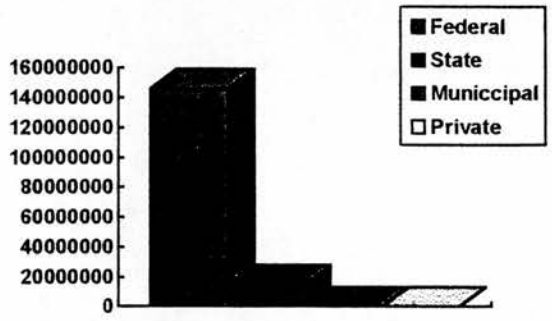

Figure 1.1 Areas of Federal, Municipal, State and Private protected areas in Brazil (after IBAMA 1995)

The categories and management objectives for protected areas adopted by IBAMA, are similar to those adopted by IUCN in 1978, and are designed according to the aims of management and importance of natural resources.

Table 1.3 Categories and designations of Protected areas adopted in Brazil (after IBAMA 1995)

Category	Designation
Category I	Scientific Reserve
Category II	National Park
Category III	Natural Monument
Category IV	Wildlife Sanctuary
Category V	Protected Landscape
Category VI	Resources Reserve
Category VII	Indigenous Reserve
Category VIII	Managed Resources Area

1.4.1 Private protected areas

The owners manage the private protected areas according to the regulations and designations of IBAMA. At present there are 93144 ha of private protected areas in four different categories Figure 1.2

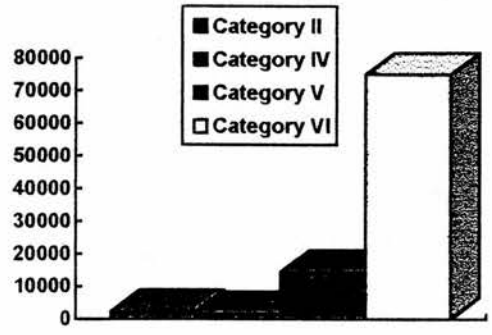

Figure 1.2 Areas and categories of Private protected areas in Brazil (after IBAMA 1995).

1.4.2 Municipal protected areas

Municipal protected areas are managed at the local level, according to legislation and designation by IBAMA. At present there are 136289 ha of municipal protected areas under five different categories of management (Fig 1.3).

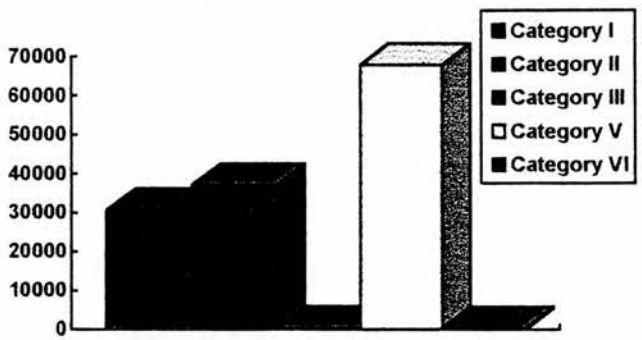

Figure 1.3 Areas and Categories of Municipal protected areas in Brazil

(after IBAMA 1995)

1.4.3 State Protected Areas

State protected areas are managed by each state according to legislation and designation by IBAMA. There are now 14448185 ha of State protected area divided into seven different categories (Fig 1.4).

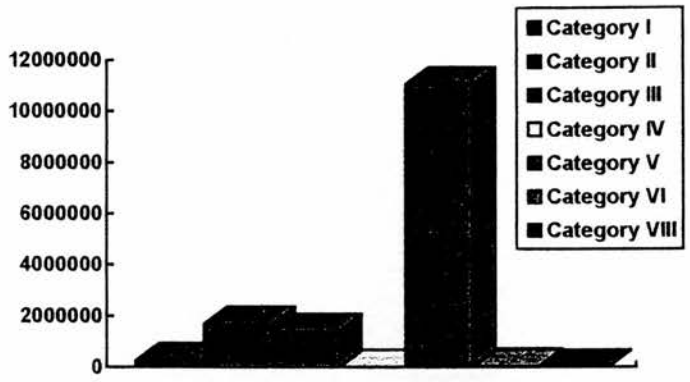

Figure1.4 Area and categories of State protected areas in Brazil (after IBAMA 1995).

1.4.3 Federal protected areas

Federal protected areas are managed and designated by IBAMA At present there are 1460 401 155 ha of Federal protected areas under eight main categories of management (Fig 1.5).

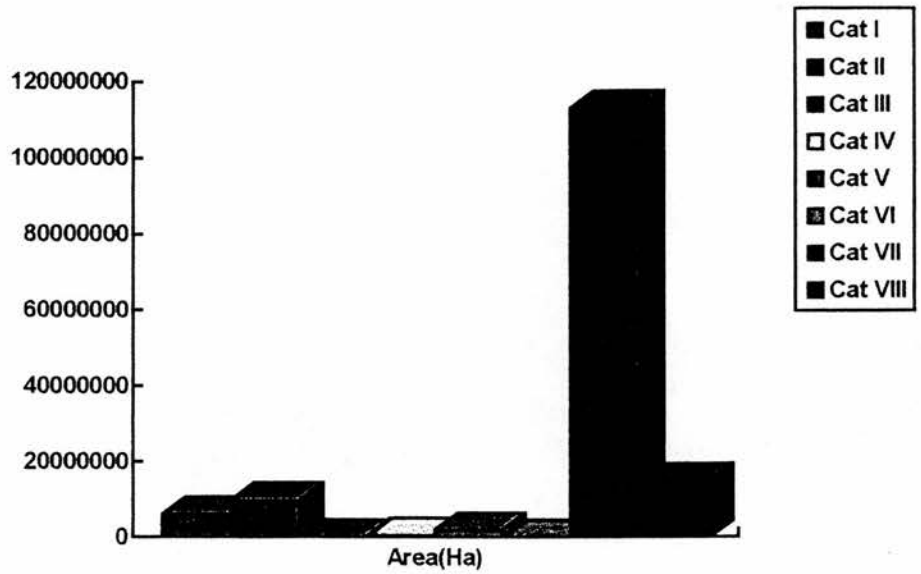

Figure 1.5 Area and categories of management of Federal protected areas (after IBAMA 1995).

Currently the main organisation responsible for the formulation and co-ordination of the national environmental policy is the Ministry of Environment and Legal Amazon (Ministerio do Meio Ambiente e Amazonia Legal) to which IBAMA is subordinated. IBAMA has one directorate dealing with protected areas: Directorate of Ecosystems.

According to SCHENKEL & KANIAK (1995), the administration within IBAMA of the non consumptive use conservation units is provided by Directorate of Ecosystems (DIREC) that is linked directly with to IBAMA presidency.(Figure 1.6)

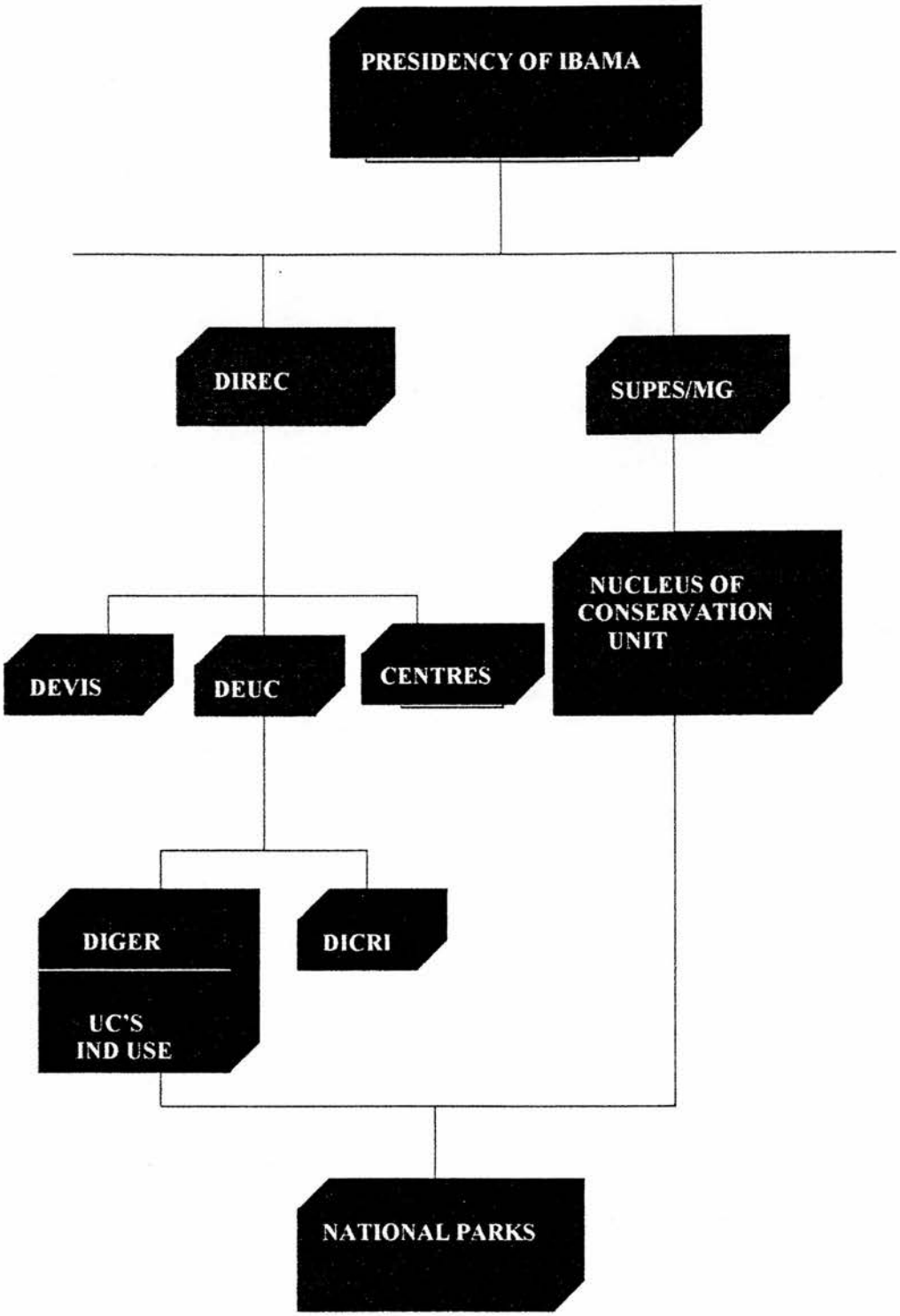

Figure 1.6 Organisational chart of the management of the National Parks (after IBAMA 1995)

The Directorate of Ecosystems (DIREC) has three main divisions Department of Wildlife (DEVIS), Department of Conservation Units (DEUC) and Centres linked to IBAMA Presidency. The Department of Conservation Units DEUC is divided into two divisions : Divisions of Management of Conservation Units (DIGER) and Division of Creation of Conservation Units (DECRI). All these Directorates, Departments and Divisions are directly involved with National Parks producing rules, technical guidance, planning, creation and monitoring.

Conservation officers that work in each Park are administratively directed by a head organisation, the, Nucleus of Conservation Units NUC which is in turn subject to the orders of the superintendent in each state.

At present, IBAMA does not have specific legislation aimed at the protected areas system, but has prepared new management categories linking private, municipal, state and national protected areas. According to SCHENKEL & KANIAK (1995), IBAMA and FUNATURA have developed an administrative agreement to prepare a system of conservation units, that has been approved by the National Environment Council (CONAMA) although it still requires approval by Congress to become law. This document divides the conservation units into three different groups and is based on the categories of management proposed by the IUCN National Parks and Protected Areas Commission in 1994.

Group I Integral Protection Units The resources in Protection Units can only be used non-consumptively and ecosystems must remain in their natural state with only minimum disturbance. The management categories are Biological Reserves, Ecological Stations, National Parks, Natural Monuments and Wildlife Refuges.

Group II Provisional Management Units The native population focuses this group in the main on the promotion of total conservation of natural resources, although it permits the provisional use of non-consumptive natural resources and sustainable use. This is to ensure that the ecosystems are maintained in their natural state until their future is decided upon. The only category in this group is the Natural Resource Reserves.

Group III Sustainable Use Units The main aim of this group is to promote the protection of natural resources whilst allowing the sustainable consumptive use of at least part of the available resources. The management categories are Fauna Reserves, Environmental Protection Areas, National Forests and Extractive Reserves.

DIEGUES (1994) observed that the objectives of the new categories of protected areas do not solve the most crucial issue in Brazilian conservation i.e the population that traditionally lives within the protected areas of Integral Protection Units. The new system does not allow the stimulation of sustainable development of human settlement in and around protected areas. For the traditional population, the conservation of natural resources means survival and socio-economic repression. The system of land compensation established by IBAMA does not compensate residents

who do not have land documents. Moreover this population is not allowed to maintain the traditional use of natural resources.

Despite the large number of Federal Protected areas, a large proportion of the conservation units have not been implemented or do not have the minimum infrastructure to function adequately. In 1992, only 20% of the protected areas had some form of management and just 10% of protected areas had a management plan, meaning that only 16 of 35 National Parks and 5 Biological Reserves had a management plan and the majority of these required updating.

IBAMA has around 120 responsibilities linked to different issues of environmental conservation. At the moment there is a study being carried out in IBAMA in order to reduce the number of responsibilities. These will be distributed to other Government Organisations and some will be privatised. According to Dias (1991), IBAMA employs 548 people to administer and manage 158000km sq. At the present there are only 3 people trained to degree level giving them the knowledge to conduct basic research activities in the conservation unit. Hence many vulnerable areas are left more or less unprotected, especially in the Amazon and more inaccessible areas.

Despite the new definition of aims and proposals for National Parks, the definition remained that given by the Federal Decree number 84017. According to this Decree a National Park was defined as :

Extensive and defined geographical areas with exceptional natural attributes permanently protected. Destined for scientific, cultural, educational and recreational purposes and created and administrated by Federal government Constitute the *wealth of the Union destined for the use of the people and should* be *preserved and*

maintained untouched by the authorities. The main objective is the preservation of ecosystems from any modification.

1.5 Land tenure in Brazil

The formation and the evolution of National Parks cannot be considered in isolation from the ownership of land. Land tenure in Brazil started during the Colonial period. According to SMITH (1972) during the colonial period the only way of granting land by the crown was by giving large tracts called *Sesmarias. Sesmarias* were described in legal Portuguese code before the discovery of America in 1496. The Portuguese representatives had rights to grant *sesmaria* and this was the only legal way of land acquisition in Brazil. Additionally, tracts also passed from public to private ownership through sale, donation, and exchange.

The process of obtaining *sesmarias* started when the future landlord occupying the land established himself on the land so he was able to get the right to become *donatario* or landlord. The concession of sesmarias was conditional upon having slaves because land that showed no sign of work or was neglected could be requisitioned by the crown and given to another landlord (MARTINS, 1983).

SMITH (1972) stresses that " Once the sesmarias were confirmed by the king, title was full and complete and the owner was exempt of any further obligation except the payment of a tenth of the produce to *God our master.* However, the King reserve the right to establish on the concession towns or villages when he judged it necessary, and also the right to use the hardwoods in the land especially for building vessels."

The Portuguese people did not accept that the rules as emigrants to Brazil entitled them to be used as cheap labour in agricultural work. Initially, the labour utilised was the indigenous people but the system of work, their rebellious spirit and Jesuit intervention it meant was not possible to work effectively. The environment and way of life of the indigenous people made it impossible to make them accept a stressful, totally different and systematic work regime, requiring the Portuguese to acquire black slaves. The main characteristics of the entire colonial period can be summarised as large property, monoculture and slave labour.

Only the white population had access to the land in *sesmarias*. The half castes and indigenous population without a tribe were put into a very difficult situation or migrated to distant regions not yet dominated by whites, living in small communities of peasants or surviving in the interior of farms as *agregados*. They were neither slaves, workers nor landlords. Any landlord that needed the land could remove this population. When a landlord arrived in a region he could easily drive out these groups. At the same time many farms were opened by utilising these people (MARTINS, 1983).

In the XVII century, decay in the sugar cane plantations attracted the plantations workers to the interior to participate in shifting stock breeding and subsistence agriculture. The expansion of the coffee economy in the last century revigorated the internal markets and increased the demand for subsistence products to supply the frontiers (HINE,1991).

The independence of Brazil in 1822 and the establishment of a Brazilian Empire marked the end of *sesmarias*. During a period of thirty years there was largely unauthorised land occupation in the country. This was the establishment of a

regime of *posse* (possession) that permitted the subordinated rural class the legal access to land and the emergence of an independent peasantry. Thus, when the international pressure for the end of slavery, which provided the potential for the emancipated slaves to gain access to the land, became a threat to the landlords' interests (labour and land), the Government solved the labour force problems by European immigration and monopoly of the land through legislation. The Land Law (Law 601, 18 /9 /1850) was promulgated in order to impede the emancipated slaves and immigrants from the plantation system from going to the interior (HINE,1991). The *Lei de Terras* (Land Law) stipulated that the title of unoccupied land could be acquired by purchase only. All lands were defined as unoccupied except those in public use, those held by legitimate title and those with legal title(SMITH, 1972).

The Land Law was against the peasants who relocated to areas not considered as sesmarias and transformed the unoccupied land into State monopoly controlled by large farmers. HINE (1991) stresses that this Law consolidated the development of the plantation system by increasing the land tenure and labour control based on large estates, establishing the legal and political conditions for the reproduction of the *latifundio.* This was the reason for the peasant's first conflicts. The peasants without land or those who did not have their land legitimated until 1850 had to work for a large farmer in order to accumulate capital and purchase the land. This type of peasant turned into a landowner was common in the South and the Southeast of Brazil (MARTINS, 1983).

The establishment of the Republic in 1891 marked a different relationship in the land tenure. Land law had fallen within the jurisdiction of the several states,

except for mineral rights and control of land along the frontiers which continued under Federal jurisdiction and administration. (SMITH, 1972).

The first Republican Constitution in 1891 transferred the unoccupied land to the states and into the hands of the local oligarchy. Each state developed a different policy for the concession of land. This was the starting point for wide scale transference of land to large farmers and colonisation enterprises with an interest in property speculation. This social process was more intense in the South and Southeast of the country. In this period the unoccupied land passed to the control of the states that had the responsibility of regulating the boundaries of farms and defining the legal situation of the properties(MARTINS, 1983). As a result of decentralised policy the land became subject to rapid appropriation due to clientilistic bargaining that encouraged the formation of *latifundios* and reproduced the concentrate structure of landholding in the colonial period by the *sesmaria* (HINE, 1991).

At the beginning of the XX century, in the First Republic the institutionalisation of oligarchic pact during the government of Campos Sales (1898-1902) started. After the abolishment of slavery in 1888, rural workers were incorporated into the mass of electors and strengthened the political power of the landlords, the land was an instrument of power. In this policy the base of government was the exchange of favours between Federal, state and municipal governments. The President of the Republic was sustained in power by the support of state governors through reciprocal clientelistic exchanges and the state governors made a similar exchange of favours with landlords (called *coronelismo)* that had the monopoly of land (HINE,1991).

The *coronealismo* was overall, a commitment and an exchange of favours between the public power and the social and political influence of the landlords. The fundamental aspect is the *coronel* who could command a large number of votes (*votos de cabresto).* This system of Government involved a complicated mechanism of favours exchange documents, transport, lodging, food, cloths, shoes, nominations of civil servants, of police and judicial authorities favouring public works contracts and land concession. Everything was paid by local political leaders in order strive to get the votes in the rural areas. The position of *coronel* was a position in the para-military organisation created in 1831 called Guarda Nacional (National Guard). During almost one century there was a *coronel* in almost every Brazilian municipality, the *coronel* was the most important local landlord or urban merchant. The habitat of *coronealismo* was the municipalities located in the interior and its vitality was opposite to the urban industrial activities (LEAL,1997).

The local population was excluded from political participation and the process of political decision–making was completely determined by the interests of the oligarchies . The large dimensions of the country, with low level of integration, poor communication networks, and rooted social structures led to a system of government imposed on an impoverished, illiterate and dependent electorate (HINE,1991).

The process of industrialisation and urbanisation grew during the last decade of the Old Republic. By the end of the 1920's oligarchic domination based on coffee production eclipsed part of this crisis which was unable to assimilate the demands of a system from new urban professionals, industrial groups and from elements from the armed forces. In the coffee economy the process of accumulation was closed

without transferring capital to others sectors of economy retaining the surplus it generated in order to reproduce its own cycle of operation on an expanded scale, while impeding industrialisation (HINE,1991).

The Lieutenant Revolution in 1930 and new electoral principles established in 1932 weakened the *coronealismo* as well the new economic and social factors. However, the political power of landlords continued untouched in many rural areas and many deputies continued to have their electoral basis from *votos de cabrestos* derived from the traditional electoral system. The agricultural production went on to produce goods to meet internal market demand created with the process of industrialisation, but the Brazilian agrarian sector remained the political domain of the traditional rural oligarchy (HINE,1991).

The inauguration of Getulio Vargas *Estado Novo* without democratic elections with the construction of an authoritarian and centralised State did not complete the transfer of the hegemony from the rural oligarchy to the emergent bourgeoisie. The landlords' powers in rural areas remained the same with minimum State interference. The major State interference was the abolishment of the National Guard. Additionally, in the *Estado Novo* the elections were suspended and the *coronel* class lost not only their main instrument of political bargain, the *voto de cabresto* but also the organisation that permitted their military and political organisation. However in many regions the landlords organised many private militias and the Military Policy remained under control of the state government still dominated by agrarian oligarchies (HINE,1991).

Agrarian protes in Brazilian history indicatethe contradictions in the system of land production and possession. During the XIX and XX centuries these acts were

defined as series of messianic and millenarian cults against the agrarian policy, which happened in the first years of the Republic and occurred in different regions of the country. As in the case of *Canudos* (1893-1897) and the involvement of Antonio, the counsellor son of a middle–class merchant, these were not led by peasants although they were in substance an expression of discontent with the conditions to which they were subjected (HINE,1991).

Banditry movement especially the *Cangaço* was an expression of antagonism against the power of the *coronel.* The religious wars and the *Cangaço* indicated disorder in the traditional relationship in the interior of Brazil. The *Cangaço* was a movement in the Northeast of the country adopted by peasants that had suffered from landlord violence.

The Messianism and *Cangaço* define the limits of peasant movements against the *coronel* power structure of the Old Republic (MARTINS, 1983). The messianic cults with their metaphysical components provide a rationality for resisting the dominant power until the moment of spiritual salvation. The cult and the form of social organisation were more important than the land. The Banditry was a expression of anger and revenge and peasants who had entered this movement no longer tilled the soil and started to reject both peasant status and socio-economic subjection (HINE,1991).

The end of the Second World War Brazil become a democratic Republic with the elaboration of a new Constitution in 1946. The country continued with the industrialisation and urbanisation process. The agrarian issue started to be emphasised as an obstacle to the country's development. Dozens of land reform projects were presented to the National Congress, however none of them was approved (PINTO, 1995).

This change in the *coronel* power radically altered the forms of conflicts of peasants; before the only resource to confront the landlords was the religious war and crimes. These developments opened a political route to the social conflicts of the1950's and the formation of Peasant Leagues *(Ligas camponesas)* (MARTINS, 1983).

The peasant leagues which appeared in the Northeast were a very important land movement of peasant history. The Peasant Leagues first started in Pernambuco with the Planters Agricultural and Ranching Society of Pernambuco and spread quickly to several regions in the Northeast, with support of the Communist party despite the opposition of the Catholic Church. The *Liga camponesa* appeared after the expulsion and reduction of peasant areas and a severe regional political crisis developed. The regional political crises were linked to ideas about regional development that could minimise the cycle of misery in the Northeast. For pressure of Peasant Leagues, the SUDENE Superintendence of Development of Northeast (Superintendência de Desenvolvimento do Nordeste) was created in 1959 and the Labours law to the countryside were extended, which legalised rural workers unions (MARTINS, 1983).

At the end of the 50's and beginning of the 1960 there were debates and popular participation about the essential structural reforms for the country's socio-economic development. This group of reforms were called Reformas de Base(Base Reforms) and implemented great transformation in agrarian, urban, bank and university structures.(PINTO,1995).

The rapid spread of unionisation forced the government of João Gulart to try to incorporate rural union organisation under corporative control by creating the

State sponsored Confederation of Rural Workers and promoting the idea of comprehensive land reform. The Peasant Leagues provoked an intense reaction of the conservative sectors of Brazilian society as a result of rural mobilisation (HINE,1991).

In this effervescent historical moment the Superintendence of Agrarian Policy (Superintendência de Política Agrária) was created SUPRA with the aims of:

a) collaborating in the formulation of agrarian policy

b) planning, promoting and executing the land reform

and supplying complementary measures of rural extension, financial, educational and sanitary support (PINTO, 1995).

The Statute of the Rural Worker (Estatuto do Trabalhador Rural) that prescribes the labour relations in rural areas was created in March of 1963. The popular participation grew rapidly and at the same time the workers started to organise the opposition. On 13 of March 1964, the President of the Republic signed a Decree promoting the expropriation of land reform of areas located along-side of Federal roads, railways and dams. On 15th of the same month the President sent to a message to the National Congress proposing some measures considered "essential and pressing to answer the old and just ambitions of the population". The first of these measures proposed was land reform. To make the land reform economic and socially viable the President asked for changes in the Constitution, in particular altering the land expropriation for social interest meaning that compensation ceased to be in paid cash prior to expropriation (PINTO, 1995).

There were many different socio-economic and political interests in dispute and on 31st of March of 1964 the Military Coup occurred with support of the

industrial bourgeois and agrarian oligarchy. After the Military Coup of 1964 (Golpe de 1964) the movement of peasants, especially the Ligas Camponesas were harshly persecuted. Before the Coupe the Institute of Research in Social Studies (Instituto de Pesquisas e Estudos Socias), IPES made a study paid by entrepreneurs about the land tenure situation and prepared a proposal for a project of land reform. This project was the basis of the program approved by the National Congress and was called Land Statute (*Estatuto da Terra*) and the Brazilian Institute of Land reform IBRA (Instituto Brasileiro de Reforma Agraria) was created (MARTINS, 1983).

Basically, the *Estatuto da Terra* was an instrument that gave power to the State to solve the conflicts and to control the occupation of land and alleviate social tensions especially in small areas. The area defined as legal Amazon in 1966 was also given to large entrepreneurs in the form of tax incentives. However, there were no subsidy for peasants installed in these areas, which illustrates the elitist character of the *Estatuto da Terra* (MARTINS,1983). The installation of large agricultural enterprises aggravated by the dislocation of the population, created a large number of land conflicts and transformed the Amazon into the region of the highest social tension (MARTINS, 1986).

The *Estatuto da Terra* that could be the answer for the centennial peasants' fights, for land in Brazil was one conciliatory proposal from the industrial bourgeois to accelerate the capitalist development in the countryside. The *Estatuto da Terra* was an attempt to solve the political and socio-economic crises in the country and as well as the agrarian issues, and at the same time allows the participation of the country in a new international order economic (ROSA, 1995).

Between 1965 and 1981 the Federal Government only made 124 Federal Decrees of land expropriation. To deal with the land conflicts Castelo Branco replaced the Federal Law that determined the payment in cash for the land for expropriation. From 1965, it has been possible to pay off the expropriation and payment in titles of public debts over a long period (MARTINS, 1986).

In 1971 the INCRA National Institute of Colonisation and Land reform (Instituto Nacional de Colonização e Reforma Agrária) was created to supersede the IBRA. IBRA was linked to the Presidency of Republic and had the status of a Ministry, while the INCRA was subordinated to Ministry of Agriculture. This change indicated a tendency to reduce the land concessions (MARTINS, 1986).

The modernisation of Brazilian Agriculture occurred towards the end of the 1970's. Agriculture passed from the traditional model to the modern model of production that combined fertilisers, pesticides, herbicides, selected seeds and other inputs with the use of machinery, land, capital and work. This was called conservative modernisation (MULLER, 1986). The modernisation of agriculture has also tended to increase the land concentration and impoverishment of peasants and rural workers (FIGUREDO, 1984). During this process of modernisation of agriculture, the land property continues as a means of production and political power. The agrarian oligarchy controlled the votes exercising a policy of clientele that is based upon the exchange of vote by political concessions. Thus, the *coronelismo* continues in the structure of agrarian Brazilian policy occupying a dominant position in the agrarian conflicts and keeping extensive unproductive *latifundio* (SANTOS, 1997).

In this period of land redefinition in favour of the large agricultural entrepreneurs, land conflicts were growing that multiplying quickly in different regions of the country involving not just peasants and rural workers but, also indigenous people whose land had been invaded. Thus, the Catholic Church especially in the west and north was deeply involved in defending the peasants, rural workers and indigenous people (MARTINS, 1985).

In the New Republic (Nova Republica) from 1985 until nowadays, the fight for land possession and land reform was transformed into the construction of a new citizenship for all that had been excluded from the land and social participation in Brazil (SANTOS, 1997).

The most important land movement started in October of 1985 when hundreds of landless peasants invaded 9,700 hectares of plantations in the south of Rio Grande do Sul state. A group of peasants started to plant Soya beans and corn in this land .They were encircled by the police and hired gunmen. In 1987 the Federal Government granted them land title and paid compensation to the landowner (PADGET, 1998).This social movement called (Land less Movement) Movimento dos Sem Terra or M.S.T is supported by left wing political parties. These included the Workers Party P.T. (Partido dos Trabalhadores) and some sections of the Catholic Church and urban trade unions (teachers, public employees, and health workers). Many unproductive areas have been invaded by members of the landless movement.

In the mid 1990's the movement spread to all regions. Also landless workers and peasants unable to subsist on tiny plots were incorporated into the movement. The growth of urban unemployment under the strict monetary policies and the

success of land occupations, with a large number of urban workers returning to the countryside and participating in the land occupation movements (PETRAS,1998).These tendencies are evidenced in the following table.

Table 1.4 Number of land occupations between 1991-1997

Adapted C.P.T 1997

Year	Conflicts	People	Occupations	Families
1991	453	554 202	77	14 720
1992	433	185 996	81	15 538
1993	545	391 128	89	19 092
1994	485	308 619	119	20 516
1995	554	381 086	146	30 476
1996	750	935 134	398	63 080
1997	736	506 053	463	58 226

Land occupation took place where there are large uncultivated farms with fertile soil, near roads, markets and credit facilities. M.S.T rejected the offer of president Fernando Henrique Cardoso to resettle in the frontier areas " because of the poor health conditions, infertile lands and lack of infrastructure and markets". To PETRAS (1998) several factors influence the land occupation:

1-Origins of movement
2-Proximity of cities
3-Level of support in adjacent urban areas
4-Level of opposition, organisation, violence and State tie of landowners
5- Concentration of landless population
6-Availability of uncultivated land
7- Previous land occupation

The geographic distribution of land occupation coincides with the social and political proximity of the others sectors. When the land occupation takes place in areas occupied by the Right, the land occupation is frequently repressed and the occupiers removed. The isolation and the occupation made up with small numbers of families made the landless vulnerable to the landlords violence and occupation failure (PETRAS, 1998).

Violence has always been present in the Brazilian countryside since the Colonial period. Political violence is found in rural areas specially under the supervision of landlords, and carried out by hired gunmen or private paramilitary. This form of violence leads to murders, attempted murder, threat of death, imprisonment, body lesions, aggressions, torture, destruction of houses, destruction of landless cultivation areas. These forms of violence involve a large number of people and large areas in Brazil every year as evidenced by the following table.

Table 1.5 Rural violence against person in Brazilian countryside between 1985 and 1997

After C.P.T.1997

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Murder	110	67	82	54	47	52	47	41	54	30
Murder attempt	76	106	90	217	48	37	62	43	71	37
Death Threat	197	194	232	263	173	156	212	155	88	92
Prison	256	401	27	261	305	272	333	833	198	381
Body lesion	153	512	130	5	91	2048	151	528	220	109
Aggression	305	1079	3348	1690	1379	717	998	2010	124	640

The data show that the number of murders, murder attempts, and death threats have been reduced slowly, but it still persists. Imprisonment has increased

due to judicial interference in the agrarian conflicts. Physical aggression, is very common because it intimidates many landless people and *posseiros*.

Table 1.6 Possessions destroyed between 1988-1997

Adapted from I.P.T 1997

Year	Houses destroyed	Cultivated land destroyed	Hectare
1988	132	1024	—
1989	306	300	—
1990	852	1175	—
1991	749	1280	7 037 722
1992	703	1040	5 692 211
1993	667	1419	3 221 252
1994	1903	5239	1 819 963
1995	1112	1589	3 250 731
1996	1337	3677	3 395 657
1997	2624	1307	3 034 706

Other types of violence committed against landless people are destruction of houses and cultivated areas. Destruction of houses and cultivated areas is a very a common practice because it destroys the material proof of land possession and after the destruction, many people leave the land behind.

The rural population has been expelled from their land for *latifundio* expansion since the colonial period. *Latifundiários,* National and International enterprises, have used contract hired gunmen to invade peasants' land and to expel this population from the land. At the moment there is a process of legalised violence to expel the landless population from the lands, as is stressed by the following table.

Table 1.7 Population expulsion from land between 1985 and 1997

Adapted from C.P.T.1997

Year	Victims of Expulsion	Victims Threat of Expulsion	Victims of Judicial evacuation	Victims of Threat Judicial evacuation
1985	2680	1425	632	0
1986	3685	735	1072	12
1987	14 738	8047	2441	0
1988	19 264	6621	2795	4000
1989	8696	4045	3938	120
1990	12 980	10 557	5078	209
1991	11 540	15 115	3317	2452
1992	10 604	5182	6298	4527
1993	10 949	5234	12 478	6500
1994	9034	4715	20 448	15 582
1995	3650	2114	13 002	13 350
1996	270	2913	17 595	19 892
1997	304	720	17 070	23 515
Total	10 8 394	67 423	106 164	90 159

A reduction can be observed in the numbers of land expulsions in the analysed period. On the other hand, also a growth of judicial evacuation can be noticed. MOREIRA(1997), call this process as *Judicialização* of violence because the right of land possession is based in the Official Law that has always protected the rural oligarchy.

Brazil has several hundred millions of hectares of uncultivated land in several regions. Also it has several hundred millions of poor cultivated land that only produce for external markets. At the same time there are 5 million landless families :

i.e. 30 million of people without land. The logic of land without people and people without land provides the basis for the land distribution movements. Up to the present the landless movement has successfully settled 200 000 peasant families on 7 million hectares. There are another 50 000 families camped outside the large farms waiting for their turn. Today less than 3% of the Brazilian population holds nearly of two thirds of the nation's half billion arable hectares (PADGETT, 1998).

"To occupy, to resist, to produce"(*Ocupar, resitir , produzir)* the slogan of landless movement seems to be the only alternative to survival for the political movement of the rural workers. This type of popular pressure can lead President Cardoso and the National Congress to create and introduce a new agrarian legislation. The agrarian paradox of the nineties shows that while the Government does not conclude the land reform projects the social movements linked to M.S.T. gets space in rural areas and indicates that only through large land occupation can land reform occur (BERGAMASCO & NARDER,1995).

The land tenure situation in Brazil also interferes with the creation of protected areas because most of the National parks are established in private land and sometimes long periods elapse before these lands are completely regulated by the State.

1.6 Land Tenure and National Parks in Brazil

The National Parks are regulated through National Park Regulations (Regulamento de Parques Nacionais Brasileiros)- Decree 84017. According to this document, the National Park is a property of the State Public property cannot be the object of commerce, private ownership or judicial guarantee and is not subject to statute limitations. A National Park can not be privatised and private property in each area of the National Park must be acquired by the State at a fair price as determined in accordance with the current owner (WEIDMAN,1995). Although the decree creating each National Park provides for fair compensation of the property, in practice this does not always occur. The main factor is slowness of public authorities in activating the expropriation process (WEIDMAN,1995).

There are two types of expropriation in Brazil.

1- Expropriation of property due to utility or necessity (Desapropriação devido utilidade publica) Regulated by decree number 3365 dated June 21 1941. The cases of public utility this decrees refers to..."the preservation and conservation of historical and artistic monuments either forming part of urban or rural entities, as well as the action necessary to maintain and enhance their most valuable or characteristics features – in addition to protection of landscapes and premises specially enclosed by nature". If much time elapses before payment, the price is corrected according with Government index of inflation. Improvements are also subject to indemnity, including those made after expropriation decree.

2- Expropriation of property for Social interest. (Desapropriação por interesse social). Article five of Federal Constitution:"... the law will establish the procedure for expropriation of property due the public necessity or utility or due social interest, through fair prior compensation in cash except in cases provided for this in this constitution " The exemptions refers to article 184 of the Federal Constitution.". The Union may demand the expropriation for reasons of social interest (including land reform) of any rural property that is not fulfilling its social function, by means or prior fair indemnity paid in agrarian debts bonds, with clauses preserving their real value redeemable in up twenty years as of the second year of issue, the use of which shall be defined by law. Additional clause one: useful and necessary improvements shall be indemnified in cash. Additional clause two the decree declaring the property as being of social interest, for land reform proposes authorises the Union to propose action for expropriation..."

In the past the IBAMA had an agreement with INCRA covering the process of land expropriation and some of these processes were expropriated for social interests. After the Constitution of 1988 the expropriation for social interest was made for land reform. The expropriations for the creation of the National Parks are now made by public utility. IBAMA made all surveys necessary for the process of expropriation as the price of undeveloped land and improvements of the farm.

The type of selection of appropriate legal mechanism for expropriation of property in the creation of a National Park should consider

the agrarian situation of each Park separately. In Parks where there are extensive and unexplored farms, the expropriation of property would be for reasons of social interests with payment in agrarian debts bonds redeemable in twenty years. In areas where the owners live and make their livelihood from their land, the expropriation should be for public utility reasons and compensation, and would be paid in cash (WIEDMAN, 1995).

Although land tenure is not the only issue linked to the establishment of National Parks it is considered essential in the management of these areas because it can generate conflicts between the Park and the local communities.

1.7 Summary

The historical perspective shows that the evolution of environmental conservation concepts in Brazil are related to the socio-economic context of the country. In the next chapter the different methodologies adopted in this study will be described in order to identify the socio-economic impact of the establishment of the National Park of Caparaó and Grande Sertão Veredas in their neighbouring communities.

CHAPTER 2

Methodology

2.1 Introduction

This chapter outlines the main methods of Environmental Impact Assessment (E.I.A.) employed in Brazil together with the other socio-economic procedures employed in the research. A matrix approach is used in the E.I.A. because it provides an effective tool to assess the environmental impact of human activities adjacent to National Parks. Socio-economic variables are analysed in order to characterise the different categories of rural producers in the neighbouring areas of Parks. Finally appropriate qualitative methods are examined as the means of providing an analysis of the social impact of the establishment of National Parks on the system of production adopted by rural producers.

2.2. Environmental Impact Assessment

The growing concern about environmental issues in the United States during the late 1960s led the federal government to announce the National Environmental Policy Act of 1969, or NEPA. This law required all those enterprises with potential to harm the environment to identify impacts that they might cause; secondly, to assess their negative effects, and finally to identify alternatives for action. Since then, under the strong influence of NEPA, many international organisations have adopted policies of Environmental Impact Assessment (EIA) in their programs of co-operation and development (SILVA, 1992). Many countries followed suit requiring EIAs from most enterprises, and the world-wide adoption of such policies during the

last decade led to an evolution in its conception, execution, and decision-making processes.

Unlike most developed countries, which introduced EIAs under the increasing pressure of an environmentally concerned population, Brazil followed demands from international agencies for development, such as the World Bank and Interamerican Bank for Development (IBAMA, 1995). The States of Sao Paulo (1976), Rio de Janeiro (1977) and Minas Gerais (1980), anticipating federal legislation, announced laws establishing systems of pollution control. At the federal level, the first important legislation concerned with environmental control was the Law 6938 of 31 August 1981, which established the National Environmental Policy (SILVA, 1992).

It was only in 1986 that the Brazilian Federal Council for the Environment (CONAMA) established by decree the requisite of carrying out EIAs before certain specified development initiatives could take place. This decree also defined the criteria and general regulations for the application of EIAs (DILGER et al. 1994). These were closely in accordance with the EIA legislation of most industrial countries. Conforming with these issues the Brazilian definition for environmental impact is considered as a qualitative change of the physical, chemical and biological properties of the environment caused by human activity, which directly or indirectly damages or influences the health or well-being of the population, including the social and economic activities, environmental resources, and aesthetic and hygienic conditions (DILGER et al. 1994).

2.3. Methods of Environmental Impact Assessment

A variety of methods were examined to evaluate their applicability to the present research. These are divided into 3 main groups:-

1-E.I.A.

2-representation techniques

3-Automated techniques

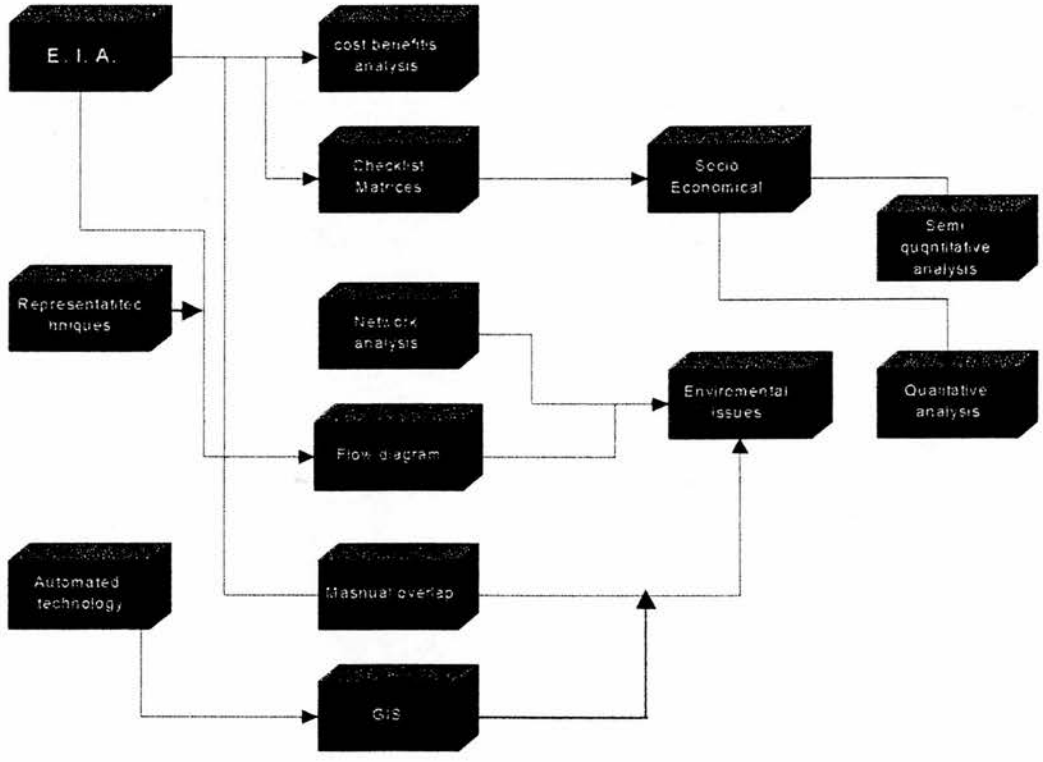

Fig 2.1 Flow diagram representative of methodology in this study.

1–Environmental Impact Assessments (EIAs) are techniques of data collecting, organising and processing, devised to allow a measure of forecasting the effects of human activities on the environment. According to BISSET (1987), this is a complex task because of the diversity of impacts and their intricate relationship with society, and secondly because the identification and assessment of these impacts demands collection and manipulation of a large amounts of data from different sources. This helps to explain the development of numerous EIA methods which have been created, accounting for the needs of countless different cases, because any combination of enterprise and targeted society-environment is unique. E.I.A.s thus represent a package of possible techniques selected and adapted to particular objectives.

Cost-benefit analysis is one of the most traditional EIA methods. It utilises natural resource data as the basis for assessment. The approach and aims of this method are therefore, more oriented towards the use and management of resources (SILVA, 1992). Cost-benefit analysis is concerned not only with the quality of the environment, but also with the effects of the activities in monetary terms, therefore expressing its conclusions in an economic cost-benefit format (IBAMA, 1995). Despite the value of its objectives, this analysis is not applicable for rapid assessments.

The *checklist* method was one of the first devised and is still used in different forms. It consists of a list of environmental features, which can be affected by the project or program, followed by a systematic assessment of the alternatives for minimising these effects. The problem with any form of checklist method is that it only addresses one side of the impact and not the connections between the impact and the various environmental components (BISSET, 1987).

The *matrix* method was devised by LEOPOLD (1971) for the United States Geological Survey. It consists of an interactive representation of the relationships between environmental impacts and human activities. The matrix works like a checklist in which all components of the system are arranged along both the horizontal and vertical axes with the matrix cells containing scores for the interaction between their two components (WATHERN, 1983). The main advantage of the matrix method rests on its ability to correlate the different land uses with interference to the various components of the ecosystem in a rapid fashion. This is of great help in understanding the complex relationship between land use and ecosystem protection. Authors such as TICHNELL et al. (1983) and MACHLIS & TICHNELL (1985) stress the convenience of using matrix methods for EIA studies in National Parks. Examples of successful use of matrix methods for Neotropical National Parks are given by MACHLIS & NEUMANN (1987, 1989), though the authors treat the interactions as threats. At the present time, according to IBAMA (1995), matrix methods are the most utilized in Brazil in the preparation of EIAs.

The *network* method was envisaged to consider explicitly the secondary, tertiary and higher-order impacts that can arise from an initial one. The network consists of a number of linked impacts known to have occurred from a variety of land uses in the past. The use of networks has the disadvantage of not providing any criteria for deciding whether any one particular impact is more serious than another (BISSET 1987, LOHANI & HALIM 1987).

2-Representation Methods Flow diagrams are similar to networks because both deal with secondary to higher order impacts and attempt to relate impacts in a segmented or parallel system. However, the former assumes that all environmental systems are based on the utilisation and processing of energy. Usually there are also links between environmental and socio-economic systems and all types of energy are translated into one common unit, e.g. money. Special attention is given to energy in

all aspects and little importance is directed to different aspects of ecological relationships (WATHERN, 1983).

Manual overlay mapping is a simple technique or EIA method with a manual application approach. Maps of the study area are prepared on transparent overlay sheets for each parameter under consideration. In each sheet the different degrees of environmental disturbance are represented by different colours or shade intensities. A map of aggregate impact is eventually obtained from the overlaying of all sheets in a base map. The overlapping may focus either in a variety of impacts or in selected sets of impacts. Despite the conceptual simplicity of this method, it is limited by the number of overlays that can be manipulated at any instant (WATHERN, 1983, BISSET, 1987). Additionally, manual methods have been largely superseded by the processing of digital images by computers.

3- Geographical Information Systems (GIS) consist of computer-based spatial maps which operate as databases whose variables may be displayed, combined and analysed with relative ease and rapidity. Conceptually, the information can reside in GIS as a series of spatially co-registered layers relating to a particular environmental theme. GIS became a good option for EIAs due to the lower cost of acquiring and processing information (MORRIS & THERIVEL 1995). However, at present there is a limitation on the use of GIS in the difference between the image and the cartographic representation on the geographical space, particularly as encountered in the traditional chloropleth map. Another limitation lies in the fact that GIS can be used only as a primary source of information in many applications related to natural resources, therefore requiring complementation from other sources of information, such as inventories, which makes the data collection aspect of the research expensive.

2.4. Environmental Impact Assessment of the National Parks of Minas Gerais

Following the recommendations of NEUMANN & MACHLIS (1987, 1989) and IBAMA (1995), a matrix approach was chosen for carrying out EIAs of the National Parks of Minas Gerais. NEUMAN & MACHLIS (1987) and MACHLIS (1992) identify socio-economic activities as the main cause of threats to Neotropical National Parks. These were used in the matrices as sources of environmental impacts caused by human activities within and around each National Park. In the matrix, socio-economic activities were collated in columns while the rows contained the main components and subcomponents of the environment.

The socio-economic activities used in the matrices were those identified in the field (most frequently observed) in the areas neighbouring the National Parks, as well as activities located within the Parks themselves. The activities recorded include: cattle raising, fire, agriculture, pesticides, fertilisers, hunting, poaching, reforestation, mining, human settlement, roads, tourism, extractivism, timber, fishery, charcoal burning and firewood collection.

Environmental components were organised into three higher level categories: physical, biological and human. Physical components include water (turgidity, chemical pollution, silted watercourses, and extractive demand), air (chemical pollution, dust and smoke), and soils (erosion, compaction, chemical pollution, nutrient losses and increased salts). Biological components include wildlife (population decreases, habitat losses, habitat alterations, animal exotic species, inadequate food supply, inadequate water supply and intoxication), and vegetation (species population decrease, habitat alterations, biomass reduction, vegetation cover reduction, exotic species and chemical damage). Human components include scenic resources (geological features, scenic views and landscape aspect), culture (monuments, buildings, cultural heritage and ethnobiological resources), and socio-

economic resources (local attitudes, conflicts, land uses, land tenure, economic resources, educational programs and extension programs).

The matrix cells thus correspond to the interaction of human activity and environmental components. These were then scored on a grading system ranking from 0 to 5, representing a scale of impact intensity, expressed as resource alteration (changes in resource quality and/or quantity) and resilience (recovery capability by natural means, i.e. without external interference) (Table 2.1). The two criteria used thus act to reduce subjectiveness.

Table 2.1. Criteria adopted for scoring the interactions between human activities and environmental components in the EIA matrices.

Score	Impact	Resource alteration	Resource resilience
0	None	-	-
1	Negligible	little	high
2	Little	little	low
3	Moderate	medium	high
4	Serious	medium	low
5	Very grave	high	low

Three matrices were applied to each of the four National Parks of Minas Gerais in communities settled either in their vicinity or within the Parks themselves. Three human settlements were chosen for each of the Park following the characteristics or criteria below:

(a) their close relationship with the Park,

(b) high pressure of their socio-economic activities over the local ecosystems,

(c) a considerable number of inhabitants,

(d) socio-economic activities representative of the of the region.

Guided by these criteria , the following settlement were selected for study:-

a)National Park of Serra da Canastra :

São Roque de Minas. This municipality contains the largest portion of the National Park of Serra da Canastra. The most important activities are cattle raising and coffee production; tourism exploitation is much less important.

São João Baptista da Serra da Canastra, this is a village located in the northern border of the Park. The main access to São Roque de Minas is made through a road that crosses the Park. The main economic activities are milk and coffee production.

São José do Barreiro. This is a village located on the margins of the São Francisco river next to the municipality of Vargem Bonita. The main economic activities are cattle raising, coffee production and diamond mining.

b)National Park of Serra do Cipó

Interna This rural community consists of a group of small farmers settled inside the Park along the margins of the Cipó River. Most holders have areas smaller than 50 ha and practice subsistence agriculture and cattle raising.

Entrada This area is located nearby the main entrance to the Park and consists of small properties and houses. Activities are either linked to agriculture or tourism exploitation.

Complexo Turístico This is the main resort centre and contains hotels, campsites and shops that were established after the increasing demand for tourism in the Park region.

c) National Park of Caparaó

Alto Caparaó. This village is within the extension of the municipality of Caparaó and is located near the park's main entrance, on the Minas Gerais side. Coffee and milk production are the main economic activities, though the expansion of eco-tourism in the Park is at present leading to the establishment of hotels, cottages and restaurants in the village.

Santa Marta. This village belongs to the municipality of Ibitirama and is representative of the most important economic activities on the Espírito Santo side of the Park. These consist of coffee cropping, eucalyptus plantation, cattle raising, quarrying (granite) and fishery (trout and tilapia).

Pedra Roxa. Another village belonging to Ibitirama municipality, Pedra Roxa is dependent on the production of coffee, milk and garden vegetables.

d) National Park of Grandes Sertão Vereda :

Chapada Gaúcha. This village belongs to the municipality of São Francisco and is located on the south-eastern borders of the Park. The main economic activities are soya, corn and rice plantations, cattle raising and charcoal production. The municipality was founded by *gaúcho* immigrants (from the southern Brazilian state of Rio Grande do Sul), and this community introduced a high technology system of agricultural production.

Vereda Santa Rita. This is a rural community settled inside the Park area and practices the traditional agriculture of the region, although some gauchos own land in the area. The main economic activities are cattle raising and subsistence agriculture.

Onça and Barbatimão. These are rural communities consisting of squatters who live on cattle raising, utilising the natural pastures of the Park. They also raise

domestic animals, such as pigs and chicken, and cultivate small plots, both for local consumption.

An overall matrix was obtained for each Park by averaging the scores of the three matrices produced for each settlement. These overall scores are summed up in order to produce total scores for rows and columns, i.e. environmental components and human activities, respectively. The row and column totals obtained for the four National Parks are displayed in bar-diagrams per each main group of environmental components: water, air, soils, wildlife, vegetation, scenic resources, culture and socio-economic resources.

The agreement among the Parks with respect to the scores represented in the bar-diagrams was tested for significance with Kendall coefficient of concordance, a nonparametric statistic for testing the association between multiple variables (KENDALL, 1962). This is particularly recommended for assessing agreement among ranks of subjective scores, such as preferences and evaluations (ZAR, 1996).

2.5 Fieldwork

In order to carry out the Environment Impact Assessment (EIA) and the analysis of the socio economic impact of the establishment of National Parks in Minas Gerais there were two phases in the fieldwork. The first phase occurred during the months of May to July of 1994 and aimed to obtain information about the environmental impact of the different human activities around the four National Parks of Minas Gerais.

The results of the Environmental Impact Assessments suggested that the most disturbed National Parks of Minas Gerais were National Park of Caparaó and

National Park of Grande Sertão Veredas. Consequently, these National Parks were selected for case studies. These results are discussed further in the following chapter.

The fieldwork for the second phase was carried out during the period of August of 1994 to June 1995. Additional fieldwork was carried out during September and November of 1997. The logistic base was located in Lavras -Minas Gerais, approximately 600 km west of the National Park of Caparaó and 900 Km south of the National park of Grande Sertão Veredas.

2.6 Socio-economic characterisation of rural producers

Several studies have been carried out in Brazil on the process of social differentiation, social characterisation and on the socio economics of production units based in the historical formation and theories about rural society. These studies provide evidence that the rural environment cannot be considered as homogeneous, because it is made up of different categories of rural producers according to the way they are integrated into the marketing system. According to ALENCAR (1986), they can be integrated into marketing as food producers, industrial raw producers or exporters of products.

Following the ideas of MOLINA FILHO (1977), farm systems can be classified into four general categories as *latifundio*, agricultural entrepreneurs, family producers and peasants. These categories can also be subdivided in function of several variables. All classifications presuppose some characteristics in such a way that members in a category are identified in the qualitative or quantitative variables

of all characteristics that define a category. It can be observed that these categories are not static but part of a dynamic social process.

Latifundios:

According to MOLINA FILHO (1977), MULLER (1982), BARAÚNA (1988), VILAS BOAS (1992) are large areas of land originating from colonial periods and remaining for four centuries. Initially, *latifundios* used monoculture and slave labour. These areas produce sugar cane, beef, cotton, coffee, soya, rice and others products for external markets.

A significant portion of *latifundios* tend not to have extensive agricultural or cattle production. Sometimes, part of the land is rented or kept in partnership. The labour force is made up of tenants, sharecroppers or salaried workers living in the area of the *latifundio.* The production in a *latifundio* is of a low technological level with little use of mechanisation or industrialised inputs. The *latifundio* owners usually do not live on the property and employ people to administer it and take responsibility for commercial and subsistence production.

Agricultural entrepreneurs:

The agricultural entrepreneur appeared as a consequence of the necessity to inject capital into agricultural exploitation and changes in the social relations of production of the *latifundios.* The agricultural entrepreneurs became stronger in the Brazilian context by exploiting monocultures such as coffee, sugar cane, cotton rice, Soya and large-scale beef raising and tended to specialize in a few cash crops with high volumes of production due to the high investments of capital. The areas of agricultural enterprise are totally exploited. The production is mechanised and there is a high consumption of modern inputs such as fertilisers and herbicides.

They tend to contract salaried workers who live in settlements close to the cultivated areas. Some rural entrepreneurs are engaged in milk or beef production and in the cultivation of other products to supply both the internal and external markets.

The agricultural entrepreneurs produce high value crops for cash. All aspects of the operation are analysed in a cost benefit analysis before decisions are made as to what crops to grow. All operations are made in order to keep enterprise in the agricultural sector ALENCAR & MOURA FILHO(1988), VILAS BOAS, (1992) BARAÚNA, (1988).

Family producers:

The production of goods is made by this group to feed the family and the excess is commercialised. However this production generates very little income.

The labour utilised is essentially family labour. The existence of other types of labour does not modify this relationship since there is a predominance of family workers.

These farmers can produce goods for internal markets such as chicken farms or external markets such as coffee or Soya. The industrial technology is utilised, with use of machinery and modern inputs. The areas of these farms are small and normally totally utilised. They are found in the vicinity of commercial agricultural systems, facilitating the use of local markets. Usually, the farmers live in the property or in villages nearby.

Peasants:

They are small-scale producers that produce subsistence crops. They are concentrated in areas of small-scale landowners and are either sharecroppers or

tenants who operate as family units. Mixed farming is a basis characteristic of these farmers who produce almost everything that they need to survive. The majority of production is for subsistence and excess goes to market commercialisation.

Much of their income is complemented by handicraft activities, although the market still forms the basis for these systems. Commercialised products form an additional income, although these often consume the activities of the peasants. ALENCAR (1986) stresses that peasants are frequently an essential part of the latifundio labour force resulting in a symbiotic relationship. This relationship can be temporary or permanent. When it is permanent the peasants live on the latifundios as sharecroppers, although when temporary they are situated around latifundios providing seasonal labour. Peasants also contribute to the labour force on capitalized farms.

The small portion of land of these properties is totally used although low or no capital is employed. The gradual increase of capital into agriculture tends to organise production to facilitate the supply of markets demands. This means the pattern of peasant subsistence tends to change and they tend to sell more to buy more, altering their basic characteristic of subsistence. VILAS BOAS(1992): BARAÚNA,(1988).

PEREZ (1975) classifies small farms units, where family labour is predominant, as hybrid types of production.

Share croppers; these are rural producers without land or with lands that are insufficient to permit them to make a livelihood. They utilise the land of other producers through a trade of "partnership" involving the sharing of production. Thus, the landlord gives the land, prepares the soil, and pays a half part of the inputs. The share croppers then pay the other half of the inputs, plant and maintain the crop,

collect the harvest and provide the labour force. After the harvest the production is divided equally.

Squatters: the long tradition within the rural population that squatters are permitted to live where they establish a base. They set up their temporary homes anywhere, constructing rough houses and making crops and harvesting a little corn and manioc and collecting natural resources. They are used to living. a nomadic life gaining a livelihood by fishing, hunting and collecting. (SMITH, 1972).

Small Scale: producers have little or no land and consequently rent land for subsistence. The rent is paid in cash and is fixed in reference to the price of the regional agricultural production. For instance, in some regions of Minas Gerais the price of the land is fixed in coffee, soya or litres of milk.

Salaried workers: they are divided into temporary workers and permanent workers. The permanent workers are those with a salary fixed in hours, days, weeks or months of labour. Usually they have specialised activities such as operators of machinery, milk cattle workers or managers of rural property. The temporary workers are paid in relation to seasonal activities.

To identify the different categories and the systems of production adopted by rural producers around the National Park of Caparaó, and around and within the National Park of Grande Sertão Veredas, a set of socio-economic basic variables were utilized. These were established by authors such as ALENCAR(1986), BARAUNA (1988), TROMBETA (1990) VILAS BOAS (1992), and include:

(a) Size of Area

(b) Gross Value of Agricultural Production(GVPA)

(c)Gross Value of Commercialised Production(GVPC)

(d) Type of labour utilised (TLP)

These variables enabled a classification to be produced of the rural producers interviewed in this study. The categories chosen permitted a characterisation of the rural producers in relation to monetary value of the production, destination of production, commercialised production and type of labour.

To complement the socio-economic profile of these producers other variables were utilised, such as:

(e) Other economics activities

(f) Education level of the rural producers

(g) Use of industrialised inputs

(h) Use of machinery

The Gross Value of Agricultural Production(GVPA) and Gross Value of Commercialised Production (GVPC) were calculated by aggregating the sales value of the outputs for each cash product during the agricultural year 1994-1995 (April 1994- June 1995).

The prices used were based on the Commodities Markets in São Paulo. Calculations have been made of the money destined for family consumption (subsistence) and animal feed. This procedure also permitted the calculation of gross value marketed in relation to the gross value of non market production. Subsistence output could then be identified, as well as to what degree each of the 86 respondents were involved with the market as food producer.

The Gross Value of Agricultural Production (GVPA) was determined by the formula GVPA=QPxPM, where QP is the quantity produced and PM is the market price. The values obtained in Reais were transformed into $US because $US is a currency used in many economic transactions in Brazil. Thus, this established the number of classes of GVPA. Levels of GVPA up to U$ 1000 were considered low;

levels between 1000 and U$ 6000 were considered medium; GVPAs between 6000 and U$ 18000 were considered high and over U$ 180000 was considered very high. The criteria adopted are traditional in Brazil and permit comparisons with other studies.

The Gross Value of Commercialised Production GVPC was calculated by the formula GVPC = QC * PM where QC is the quantity commercialised and PM is the market price. The value of GVPC was calculated as a percentage in relation to GVPA (GVPC/GVPA*100). This proportion permitted an identification of categories for subsistence and those for market produce.

To calculate the proportion of total family labour in relation to total labour in farming activities, a set of procedures were utilised which were first adopted by ALENCAR & MOURA FILHO (1988).These procedures permitted the calculation of the total labour absorbed by the (TLP) farm and the total of the family(TFL). To determine the proportion of labour absorbed by the rural property, the following formula was used TFL/TLP*100. The following illustrates the procedure:

1-Identify the type of labour time spent in farming activities e.g. family, permanent workers, temporary workers, or sharecroppers

2- the number, age, sex and time spent in work of each group of people

3- Transformation of the time spent by men , women and children into one uniform measure called "man equivalent "

The man equivalent corresponds to the work of an adult man in 300 days of work . One work day corresponds to 8 hours or one man day. For the calculation of total labour utilized in each farm, the work of women and children was converted to man equivalent according to the table in ALENCAR & MOURA FILHO (1988).

4- Combination of on farm and off farm jobs in supplementing family income . In this case supplementing involved other activities such as share cropping, and temporary or permanent wage labour by respondents or family members.

5-The level of schooling and the background of the farmer.

6 The use (or not) of industrialised inputs. This indicator also described the system of production adopted by the farms.

7-The use of machinery and the relationship with the system of production.

Using the seven variables described above, respondents were classified in 4 categories of rural producers. The first step was to classify according to the following indicator a) size of area b) GVPA c) proportion of GVPC in relation to GVPA d) combination of family labour as a proportion of total labour time employed in farm activities. The second step was to define the main characteristics of categories as peasants, family farms entrepreneurs with medium level of income, entrepreneur with high level of income.

Peasants includes general characteristics of peasant units in Brazil as subsistence production (low Gross Value of Agricultural Production), family labour and off farm wage to supplement household income. Family farms resemble the first category; however in this category the household income was not complemented by the combination of on-farm and off-farm work. In addition the GVPA and the GVPC in this category was higher than in Peasants.

Entrepreneurs with medium level of income approaches Entrepreneurs with high level of income in that family labour as a proportion of total labour engaged in agricultural activities was relatively low. Family labour as a proportion of total labour was used to distinguish a proportion of total labour in case of similar GVPA. The main difference between entrepreneurs with medium and high levels of income was related to GVPA.

Farming systems of production constituted a further indicator, completing this classification. These methods include the use of inputs such as fertilisers and lime, as well as improved seeds, seedlings, vaccines, animal fodder, pesticides,

herbicides and finally the use of machinery and implements owned by the rural producers.

A characterisation of the socio economic profile of each was developed from the calculation of the basic variables of the farmer, giving 4 categories of rural producers peasants , family producers , producers with medium levels of income and rural producers with high level of income.

2.7 Qualitative research

In choosing the techniques for data collection, along with other instruments used in scientific investigation, it is important to be aware of the linkage between the problems of research, as well as the theoretical references that validates the methodology.

Qualitative research is a method and analytical procedure used for solving problems of enquiring in Social Sciences. These methods of data collection have been employed by Social Scientists for many years.(BORMAN et al, 1986).

There are four common methods in qualitative research, observation, analysing texts and documents, interviews and recording and transcribing. These methods are often used in combination with observation and interviewing and can be used in qualitative or quantitative studies (SILVERMAN, 1993). The combination of quantitative and qualitative research in conjunction may often allow access to different levels of reality because qualitative and quantitative research have their own strengths and each will be relevant to some issues but not to others. (BRYMAN, 1989).

The most fundamental characteristic of qualitative research is to express commitment to viewing events , actions, norms and values from the perspective of people who are being studied. (BRYMAN, 1988).

2.7.1 The interviews

The interview is one of the most powerful methods in qualitative research for descriptive and analytical purposes. The long interview can take us into the mental world of the individual and construct his relationship with different subjects. (MCCRACKEN,1984). Many qualitative researches prefer to employ verbatim quotations, from interview replies in order to illustrate general points (BRYMAN, 1988).

BOMTEMPO (1994) and DECANINI (1997) stress the importance of this technique in studies concerning National and state parks in Brazil. These authors also consider the interview important to cross check data gathered from other sources such as documents and observation previously made.

Questionnaires consisting of open ended questions were conducted with the farmers neighbouring the National Park of Caparaó and National Park of Grande Sertão Veredas. According to HAGURTTE (1987) LAKATOS and MARCONI (1988), open ended questions are helpful to obtain information and allow an investigation of plans and motivations for actions, both present and past, along with feelings and attitudes. According to these authors this approach gives more flexibility to the interaction between researcher and interviewees, during data collection.

The questions that constituted the questionnaire looked at the events linked to the establishment of the National Parks as well as the impact on the neighbouring rural communities, both during the establishment and the ongoing relationship.

The selection of farmers to be interviewed in this study was based on the distance of their properties from the National Park. Farms located a maximum distance of 10km from the borders of each Park were selected to consider those

farmers most affected by the establishment of the Parks in the communities. The interviews lasted whole mornings, afternoons or evenings. Sometimes the same questions were repeated in different forms to clarify important points or to stress relevant issues or to act as a check on uncertain points.

In order to conform to statistical parameters, interviews were carried out on 15% of rural producers in each area, as well as the use of key informants to give sufficient detailed understanding of the relationship between farmers and National Parks.

2.7.2 Participant Observation

Participating observation is fundamental to understanding the routine rather than what appears important in people's life (SILVERMAN, 1993). Participating observation and interviews are the major methods in qualitative research. (BRYMAN, 1988).

Observation varies and participant observation varies from complete participant to complete observer. Participant observation involves taking the viewpoint of those studied, understanding the character of interaction and viewing social process over time. Some authors argue that if one is really to understand a group of people it is essential to be engaged in an extended period of observation.

Participant observation was utilised in each research area. In the National Park of Grande Sertão Veredas this author was also teacher of biology and sociology in the secondary school of Moacir Candido in the municipality of Chapada Gaúcha, so week days were spent in the other villages and week ends in Chapada Gaúcha. This methodology made it possible to participate and observe intensely the social life of the communities. Also through this technique it was possible to participate in

important events in different communities such as planting soya in Chapada Gaúcha, *Folia de Reis* in Onça, *Nossa Senhora Aparecida* Mass in Carinhanha and others.

The participation also allowed participation in the social life and important events of community life in Caparaó such as coffee harvest in Pedra Roxa and religious ceremonies in Santa Marta.

The observation was registered in notebooks and the interviews were recorded on a tape.

Following the suggestions of ANDRE(1989) and TRIVINOS (1987) the process of analysis involved exhaustive readings of interviews. Primarily though, the information gained from rural producers neighbouring the national parks formed the empirical material used in this study, and allowed an understanding of the significance of National Park establishment for rural producers.

There were two opportunities for research and this work could be a study of the policy of management of National Parks and the institutional analysis involved in the political context or a study of the problem of rural communities and National Parks in the field. Using the rural producers perceptions about the interference of National Parks in the rural communities and not the political context, made the latter more relevant to the management of protected areas in Brazil because there few studies about the interference of National Parks over the rural communities in Brazil.

Summary

The different techniques used in this study add flexibility to the gathering of data during the field work. The matrices were relevant in obtaining data about environmental impact assessment in the National Parks of Minas Gerais as will be demonstrated in the next chapter.

The use of semi–structured questionnaires facilitated the collection of more specific data about the different categories of rural producers and the diverse land use around National Parks. This information will be described in chapters four and six.

CHAPTER 3

Environmental impact assessment of the National Parks of Minas Gerais State Land use and Protected Areas

3.1. Introduction

This chapter examines the Environmental Impact Assessment implemented in the National Parks of Minas Gerais. An historical approach is adopted to identify the varying land uses in the different historical periods of Minas Gerais history and the establishment of protected areas. This chapter also provides a physical description of the four National Parks of Minas Gerais. Finally, this chapter examines the use, and the resulting matrix to assess the environmental impact of human activities in three villages neighbouring the National Parks.

3.2 Land Uses and Protected areas

Minas Gerais State was colonised by *Bandeirantes* from São Paulo. These were men, usually Portuguese or half caste (*caboclos*), who roved Brazil's hinterland from mid XVI Century to late XVIII Century in search of minerals and Indian slaves. Around 1696, the discovery of gold and diamonds in a large area, later known as Minas Gerais (Portuguese word for general mines), triggered the first gold rush in the country (PRADO JR, 1945).

Although the *Bandeirantes* were essentially nomadic, they established a number of stopping points along the routes linking the coastal provinces of São Paulo

and Rio de Janeiro to the mining interior provinces which eventually developed into small to larger settlements (DICKENSON, 1982). A similar process occurred along the São Francisco River valley following the expansion of cattle raising from North-eastern Brazil towards Minas Gerais, which settled pastoral communities alongside the cattle routes. With the decline of mining activities in Minas Gerais during the second half of XVIII Century, agriculture based on slave labour and *latifundio* became the main economic activity.

The present day Minas Gerais State has a population of 15931961 inhabitants unevenly distributed over an area of 586624.3 km² (IBGE, 1995), which is mostly an extremely altered landscape, by human activities such as mining, extensive cattle raising, agriculture, wood charcoal production, and other industries. These economic activities have caused intense disturbance to nearly all ecosystems of the State. As a result of this, from the 1920's onwards, several protected areas have been established in Minas Gerais State with the aim of safeguarding samples of the different ecosystems of the State which had suffered little to no impact from human activities.

Despite all efforts devoted to the conservation of protected areas in Minas Gerais their present situation is far from satisfactory, since most of them face problems such as undefined land tenure, illegal poaching, firewood extraction, agriculture, cattle raising, mining and arson. Although some of these environmental impacts happen due to the activities of humans settled within the protected areas, most have their origin in neighbouring communities. The purpose of this study is to carry out an assessment of environmental impacts caused by these disturbances on the natural resources of National Parks in Minas Gerais State.

3.3. Protected areas in Minas Gerais

Governmental initiatives within the present-day protected areas in Minas Gerais State date back to 1859 when Emperor D. Pedro II determined that the Empire flag should be raised upon the summit of the Pico da Bandeira (Portuguese 'Flag Peak'), which was then thought to be the highest geographical point of Brazil (BOMTEMPO,1994). The first protected area established in Minas Gerais State was the Cataguases State Park, in 1923. It is situated in south-eastern Minas Gerais, and is covered by rainforests, the total area being 69 ha (IBAMA,1995). The first Brazilian National Park, Itatiaia, created in 1937, has most of its area within Rio de Janeiro State, although it has expanded into Minas Gerais. From that year onwards several other protected areas have been created in the State totalling 78 units with an area of 830636 ha at present (Table 3.1). However, these protected areas correspond only to 1.42% of the State's surface. They are administered by private owners, municipalities, the State, or the Federal Government. Although the State is responsible for most units (49.4%), the federal areas comprise by far the largest area (Fig. 3.1).

Table 3.1. Protected areas of Minas Gerais State, after IBAMA (1995).

Category	Number	Area (ha)	% State Area
Federal	26	707860	1.210
State	39	119403	0.200
Municipal	12	2507	0.004
Private	1	850	0.001
Total	78	830636	1.420

The single private protected area in Minas Gerais is the Ibiruçu Ecological Park, owned by the mining company Vale do Rio Doce (Table 3.2). It has an area of 850 ha and covers only 0.001% of the State area.

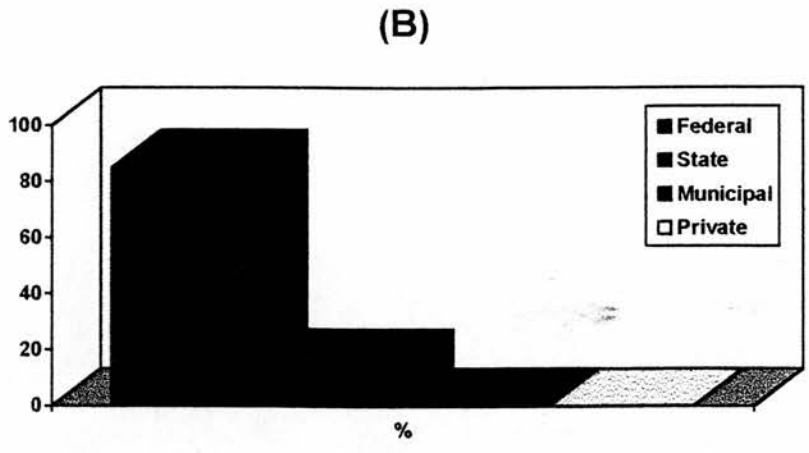

Figure 3.1. Relative number (A) and area (B) of conservation units administered by the Federation, the State, municipalities and private owners in Minas Gerais State.

Table 3.2. Protected areas in Minas Gerais State under private ownership, after IBAMA (1995).

Category	Number	Area (ha)	Proportion (%)
Ecological Park	1	850	100
Total	1	850	—

Municipal protected areas in Minas Gerais correspond to a total of only 2507 ha or 0.004% of the state's surface. The 12 units are classified as Biological Reserves and Forest Parks (Table 3.3).

Table 3.3. Protected areas in Minas Gerais State under municipal management, after IBAMA (1995).

Category	Number	Area (ha)	Proportion (%)
Biological Reserves	7	1956	78.02
Forest Parks	5	551	21.98
Total	12	2507	—

There are also 119 419 ha (0.2%) of State protected areas in Minas Gerais, which are managed by the Instituto Estadual de Florestas (IEF). These are State Parks, Permanent Protected Areas, Biological Reserves, Ecological Stations, State Natural Monuments, and Environmental Preservation Areas (Table 3.4).

Table 3.4. Protected areas in Minas Gerais under state management, after IBAMA (1995).

Category	Number	Area (ha)	Proportion (%)
State Parks	11	87701	73.43
Permanent Preservation Area	9	15468	12.95
Biological Reserve	15	15334	12.84
Ecological Station	1	700	0.59
State Natural Monument	2	200	0.17
Environmental Preservation Area	1	16	0.01
Total	39	119419	—

Federal protected areas in Minas Gerais cover 707860 ha, corresponding to 1.21% of State area. They are managed by the Superintendência Estadual do Instituto Brasileiro de Meio Ambiente e Recursos Naturais Renováveis in Minas Gerais (Superintendency IBAMA–MG) and fall into nine categories: Ecological Stations, Forest Stations, University Ecological Reserves, National Parks, National Heritage Areas, Natural Monuments, Environmental Protection Areas, Indigenous Reserves, and National Forests (Table 3.5).

Table 3.5. Protected areas in Minas Gerais under federal management ranked by their total area (after IBAMA 1995).

Category	Number	Area (ha)	Proportion (%)
Environmental Protection Areas	4	359345	50.76
National Parks	4	215325	30.41
Natural Heritage Areas	9	63084	8.91
Indigenous Reserves	1	56375	7.96
Natural Monuments	3	11600	1.64
Ecological Stations	1	1090	0.15
University Ecological Reserve	1	404	0.06
National Forests	1	348	0.05
Forest Stations	2	289	0.04
Total	26	707860	—

3.4 National Parks of Minas Gerais

Among the categories of Federal Protected Areas in Minas Gerais, the National Parks are of particular interest due to their multiple purposes, which include scientific, educational and recreational uses. In addition to this, they represent 85.1% of all protected areas in the State, therefore assuming a paramount importance within the net of protected areas.

At the moment there are four National Parks in Minas Gerais, covering an area of 215325 ha (0,03% of the state's area). These are the Grandes Sertão Veredas, Serra da Canastra, Serra do Cipó and Caparaó National Parks (Fig. 3.2.). A fifth National Park, Itiaiaia, has part of its area in Minas Gerais, but was not included in this study because it is administered from the state of Rio de Janeiro, where most of its natural resources are located. Similarly, Caparaó National Park is shared by Minas Gerais and Espírito Santo States but is administered from the former.

Figure 3.2. Geographical situation of the National Parks (PN) of Minas Gerais State.

The four Parks are representative of the two most important biomes of the State: the *cerrados* (woody savannahs), which are present in the first three Parks, and the highly endangered Atlantic rainforests, present in the latter Park. The latter three also include *campos rupestres*, a specialised vegetation which grows on rocky mountain tops and is rich in endemic (and threatened) plant species (HARLEY, 1995). Descriptions of each National Park follow below.

3.3.1. National Park of Serra da Canastra

The National Park of Serra da Canastra was established on 5 April 1972 by the Federal Decree 70335. It is situated in southwestern Minas Gerais (Fig. 3.2) at 20°10'–20°20'S and 46°15'–47°00'W. The proposed area was 200000 ha, initially, but political pressure led to a reduction to 71525 ha (OLIVEIRA, 1992).

The Park area extends over the municipalities of Sacramento, Delfinópolis and São Roque de Minas, the latter showing the strongest links with the Park, since the town is close to the main entrance and centres of attraction, and includes two villages, São João Batista da Serra da Canastra and São José do Barreiro (Fig. 3.3) whose communities interact strongly with the Park (OLIVEIRA, 1992).

According to the Köppen's classification the predominant climate of the region belongs to sub-group Cwb, i.e. with a cool dry- winter and a warm rainy- summer. The mean monthly temperature is below 18°C in the coldest month, July, and does not exceed 24°C in warmest month, January. The annual rainfall ranges between 1300 and 1700 mm (IBDF 1981, IBAMA 1993).

The Park area is essentially an isolated plateau, the Serra da Canastra, which stretches from East to West and shelters several water sources, the most important of which is the São Francisco river, the longest among the entire Brazilian rivers. The plateau also divides the catchment area of this river from that of the Paraná river. The altitude at the top of the plateau varies between 800 and 1200m, while the surrounding escarpments may reach 200 m of vertical descent.

Several lithological formations are found throughout the Serra da Canastra, but the predominant one is the pre-Cambrian quartzites and mica-schist from the Canastra Group. There are also some small areas of mica-schists from the Araxá Group. Soil fertility is generally very low, with a predominance of sandy, shallow, rocky and poorly drained soils, which are highly prone to erosion (IBDF, 1981).

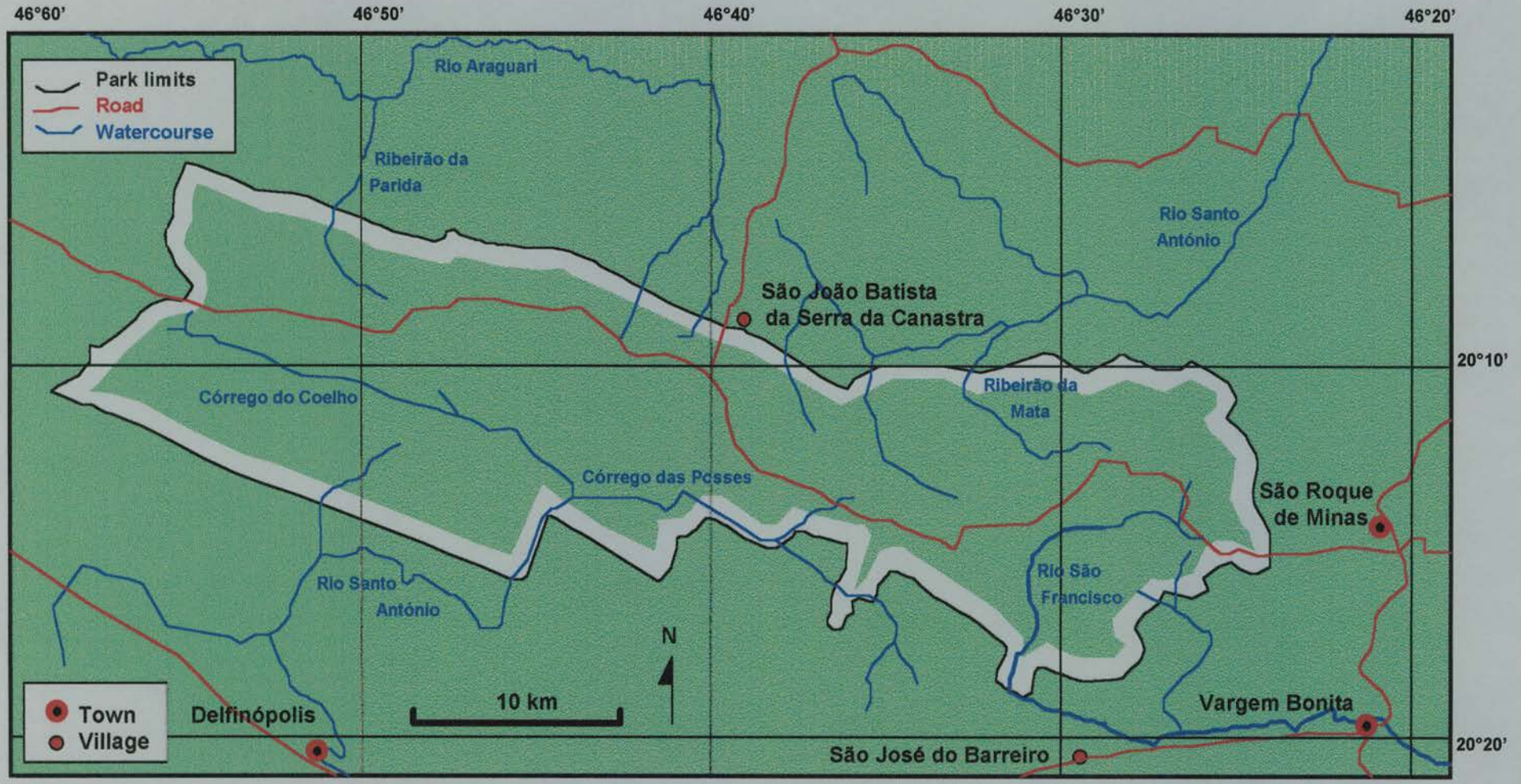

Figure 3.3. Map of the Serra da Canastra National Park and associated human settlements.

The predominant vegetation is cerrado (woody savannah), which is mostly found as its open physiognomic forms: campo sujo and campo limpo (open grasslands with and without scattered shrubs, respectively). Campo rupestre (montane rocky savannah) is found over rock outcrops on the top of the plateau. Forests are found as galleries along the water courses. The predominant woody genera on cerrado areas are *Caryocar*, *Vochysia*, *Kielmeyera*, *Miconia* and *Curatella*, while species of the families Gramineae and Cyperaceae predominate on the grassy layer. The most important families on the campo rupestre are Velloziaceae, Melastomastaceae, Compositae, Orchidaceae, Araceae, Eriocaulaceae, Xyridaceae and Lycopodiaceae (IBDF, 1981). The important plant families in gallery forests are Myrtaceae, Leguminosae, Sapindaceae, Meliaceae, Annonaceae and Melastomataceae (MOTA, 1984).

Among the notable species of the Park's fauna are the giant anteater *Myrmecophaga tridactyla*, the giant armadillo *Priodontes maximus*, the maned wolf *Chrysocyon brachyurus*, the ocelot *Felis pardalis*, the puma *Felis concolor*, the howler monkey *Allouatta caraya*, the capuchin monkey *Cebus apella*, the tamarind *Callithrix penicillata*, the rhea *Rhea americana*, the seriema *Cariama cristata*, the toucan *Rhamphastus toco*, and the white vulture *Sarcoramphus papa* (IBDF 1981, 1983, IBAMA 1993).

3.3.2. National Park of Serra do Cipó

The Serra do Cipó National Park was created on 25 September 1984 by the Federal Decree 90223 which changed its status from State Park to National Park. It is

located at 19°20'–19°33'S and 44°18'–44°32'W, in the central region of Minas Gerais State around 70 km northeast of Belo Horizonte, the State's capital (Fig.3.2). The Park has an area of about 33800 ha.

The Park is situated within the municipalities of Santana do Riacho, Morro do Pilar, Itambé do Mato Dentro, and Jaboticatubas, whose two villages, Cardeal Mota and São José da Serra are the settlements most closely related to the Park (Fig. 3.4) (IBAMA, 1984).

The climate is tropical montane, or Cwb using Köppen's classification, i.e. characterised by cool dry winters and warm rainy summers. The mean annual temperature and rainfall are 21.2°C and 1622 mm, respectively (FUNDAÇÃO JOÃO PINHEIRO 1976, IBAMA 1984).

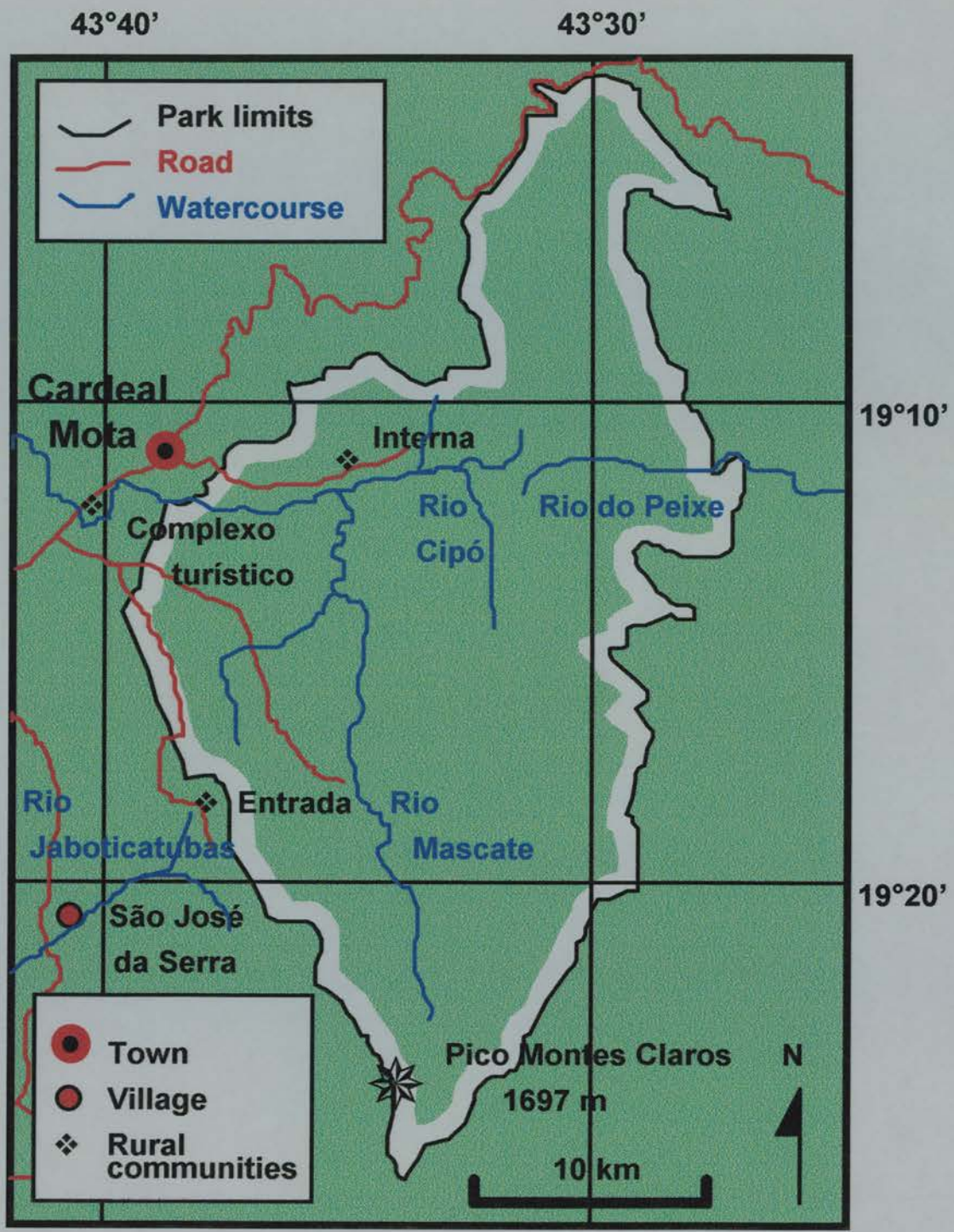

Figure 3.4. Map of the Serra do Cipó National Park and associated human settlements.

The Serra do Cipó is one of a series of smaller mountain ranges, which form the Serra Espinhaço, a long main mountain ridge which extends from southern Minas Gerais State to central Bahia State. A rugged relief with vertical escarpments and very steep slopes predominates in the whole Park where altitudes range between 850 and 1600 m. The main ridge represents the divide between two major river basins: the Rio das Velhas, to the West, and Rio Doce, to the East. The predominant geological formations are quartzites of the Espinhaço Group and calcareous rocks of the Bambuí Group (FUNDAÇÃO JOÃO PINHEIRO, 1976).

The predominant vegetation is the campo rupestre, with cerrado occurring in small patches at lower altitudes and forests found as capões (forest islands) or galleries (FUNDAÇÃO JOÃO PINHEIRO,1976). The predominant plant families are Velloziaceae, Melastomataceae, Umbelliferae, Vochysiaceae, Orchidaceae, Eriocaulaceae and Bromeliaceae, for campo rupestre, Vochysiaceae, Euphorbiaceae, Meliaceae, Lauraceae and Moraceae, for forests, and Vochysiaceae, Leguminosae Myrtaceae and Malpighiaceae, for cerrado (GIULIETTI et al. 1987).

Wildlife in the Serra do Cipó National Park includes the maned wolf (*Chrysocyon brachyurus*), the wild dog (*Speothus venaticus*), the collared anteater (*Tamandua tetradactyla*) among the mammals, and the seriema (*Cariama cristata)* and several falcon species among the birds, in addition to many high altitude specialised fish and amphibian species (FUNDAÇÃO JOÃO PINHEIRO, 1976).

3.3.3 National Park of Caparaó

The Caparaó National Park was established on 24 May 1961 by the Federal Decree 50648, which changed the status of the Federal Reserve of Pico da Bandeira. It is situated at 20°19'–20°37'S and 41°43'–41°53'W with an area of 7800 ha in Minas Gerais State and of 18200 ha in Espírito Santo State (registered land only). The Park occupies areas of the municipalities of Caparaó, Espera Feliz and Alto Jequitibá, in Minas Gerais, and Dores do Rio Preto, Divino de São Lourenço, Ibitirama and Iúna, in Espírito Santo (IBAMA, 1995). Although the Park has most of its area in Espírito Santo it is managed from Minas Gerais. The most important human settlements around the Park are the villages of Alto Caparaó (district of Caparaó municipality), on the Minas Gerais side, and Santa Marta and Pedra Roxa (districts of Ibitirama municipality), on the Espírito Santo side (Fig. 3.5).

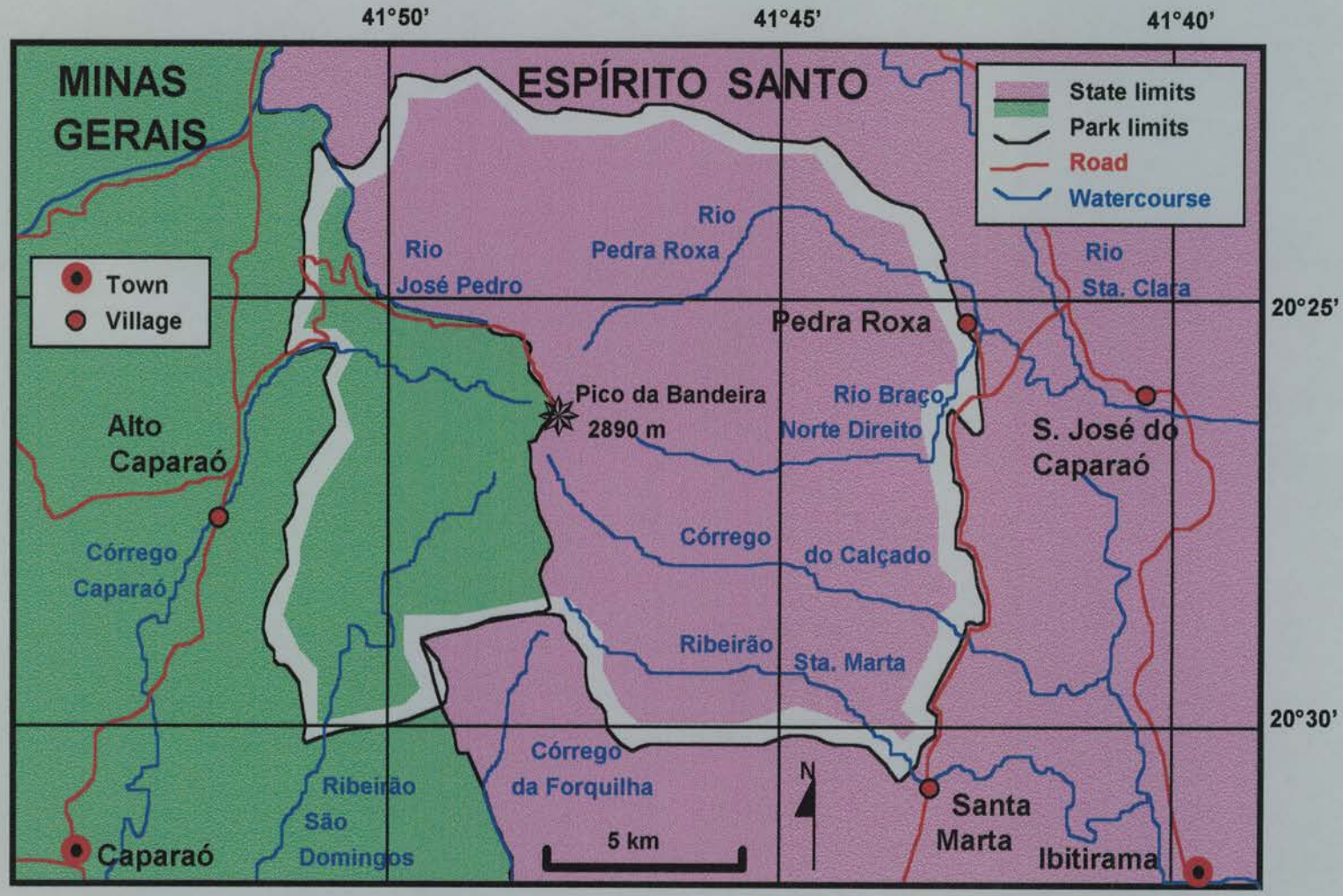

Figure 3.5. Map of the Caparaó National Park and associated human settlements.

The Caparaó National Park has a tropical montane climate which shows a striking local variation following altitudinal levels and slope aspect. The mean annual temperature ranges between 19 and 21°C, with minimum daily temperatures often reaching -4°C on the higher mountain slopes during the winter months, when there are frequent frosts. The annual rainfall ranges between 1250 and 1500 mm, with 50% concentrated between November and January (IBDF,1981). The oceanic influence produces higher precipitation on the eastern slopes where the climate may be classified as Köppen's Awb type, as opposed to the Cwb type on the western slopes.

The topography is characterised by a rugged surface with very steep slopes. Altitudes range from 997, at the lowest point, to 2890 m on the Pico da Bandeira, the third highest mountain in Brazil. The Serra do Caparaó Park range represents the easternmost part of the Serra da Mantiqueira, a mountain system that extends from West to East, mostly within southern Minas Gerais. The Serra do Caparaó originated from a tectonic uplift and is mostly composed of Precambrian gneiss granites (IBDF, 1981). There are several watercourses with their sources in the Park, the most important of which on the Minas Gerais side are the Caparaó, São Domingos and José Pedro rivers, which flow to the Rio Doce basin. On the Espírito Santo side, there are the Calçado and Santa Marta rivers, which belong to Rio Itabapoana basin, and Braço Direito and Pedra Roxa rivers, which belong to the Rio Itapemirim basin (IBAMA, 1995).

Tropical rain forests are the predominant vegetation type on the Espírito Santo side, while in Minas Gerais they cover the mountain slopes reaching an altitude of approximately 1800 m. from this level upwards the vegetation is essentially campos rupestres. The area of tropical rain forest is mostly secondary, especially in Minas

Gerais, where the predominant species are *Cecropia hololeuca, Piptadenia gonoacantha, Tibouchina* spp., *Miconia* spp., *Croton* spp., *Cariniana estrellensis, Cabralea canjerana* and *Cedrela fissilis*. Typical forest species along water courses are the palm heart *Euterpe edulis*, and the tree ferns *Cyathea* spp., *Alsophila capensis* and *Dicksonia sellowiana* (IBDF 1981, 1983). In the areas of campo rupestre the characteristic species are *Chusquea pinifolia, Vellozia* spp., *Barbacenia* spp., *Zygocactus* sp., *Mimosa* sp., *Calliandra* sp. and several Bromeliaceae, Ericaceae, Orchidaceae, Compositae, Myrtaceae and Melastomataceae (IBDF, 1981).

The most important animals of the Park are the margay *Felis wiedii,* the wild rabbit *Sylvilagus brasiliensis*, the paca *Agouti paca*, the woolly spider monkey *Brachyteles arachnoides*, the crab-eating racoon *Procyon cancrivorus*, the taira *Eira barbara* and the bush dog *Cerdocyon thous*, among the mammals, and the inambu *Crypturelus obsoletus*, the buzard *Buteo magnirostris*, the falcon *Milvago chimachima*, and many hummingbird species, among the birds (IBDF, 1981).

3.3.4. National Park of Grande Sertão Veredas

The National Parkof Grandes Sertão Veredas is located in northwestern Minas Gerais State on the borders with Bahia State, at 15°30'–15°00' S 45°30'–46°05' (Fig. 3.2). It was established on the 12th April 1989 by the Federal Decree 97658. The Park has an area of 84000 ha, occupying areas of the municipalities of Formoso and Januária. These are very large municipalities whose main towns lie at a distance from

the Park (75 km and 172 km by road, respectively). Therefore, the single main human settlement within the vicinity of the Park is the municipality of Chapada Gaúcha, which was a district of São Francisco municipality (Fig. 3.6). However, there are several farms and rural communities inside the Park area.

The climate is typically of savannah type, i.e. warm tropical with a marked winter dry season (Aw on Köppen's classification). The mean annual temperature is 26,4°C; the lowest and highest monthly means occurring in July (17,8°C) and January (33,2°C) (INDI 1994). The annual rainfall is 773 mm, ca. 80% concentrated in November–February (INDI, 1994).

The topography is very gentle, with broad interfluves, leading to deficient drainage in most of the area. Therefore, during the rainy season the water table outcrops over extensive areas, regionally called *veredas*. These are seasonal marshes with hydromorphic soils liable to an annual cycle of waterlogging followed by drying out. The Park's veredas shelter the sources and courses of several creeks and rivers, all discharging into the Rio Carinhanha a main tributary of the São Francisco river which also delimits the states of Minas Gerais and Bahia. The most important watercourses within the Park are the Rio Mato Grande, Rio Preto and Santa Rita.

Three vegetation types are found within the Park: cerrado, vereda and gallery forest. Cerrado is the predominant vegetation type and it appears in three physiognomic forms: the campo sujo (open grassland with scattered shrubs), cerrado *sensu stricto* (tree-and-shrub savannah), and cerradão (predominantly arboreal savannah). Veredas are typical of headwaters and river side valleys while galleries are found along valley bottoms (FUNATURA,1989).

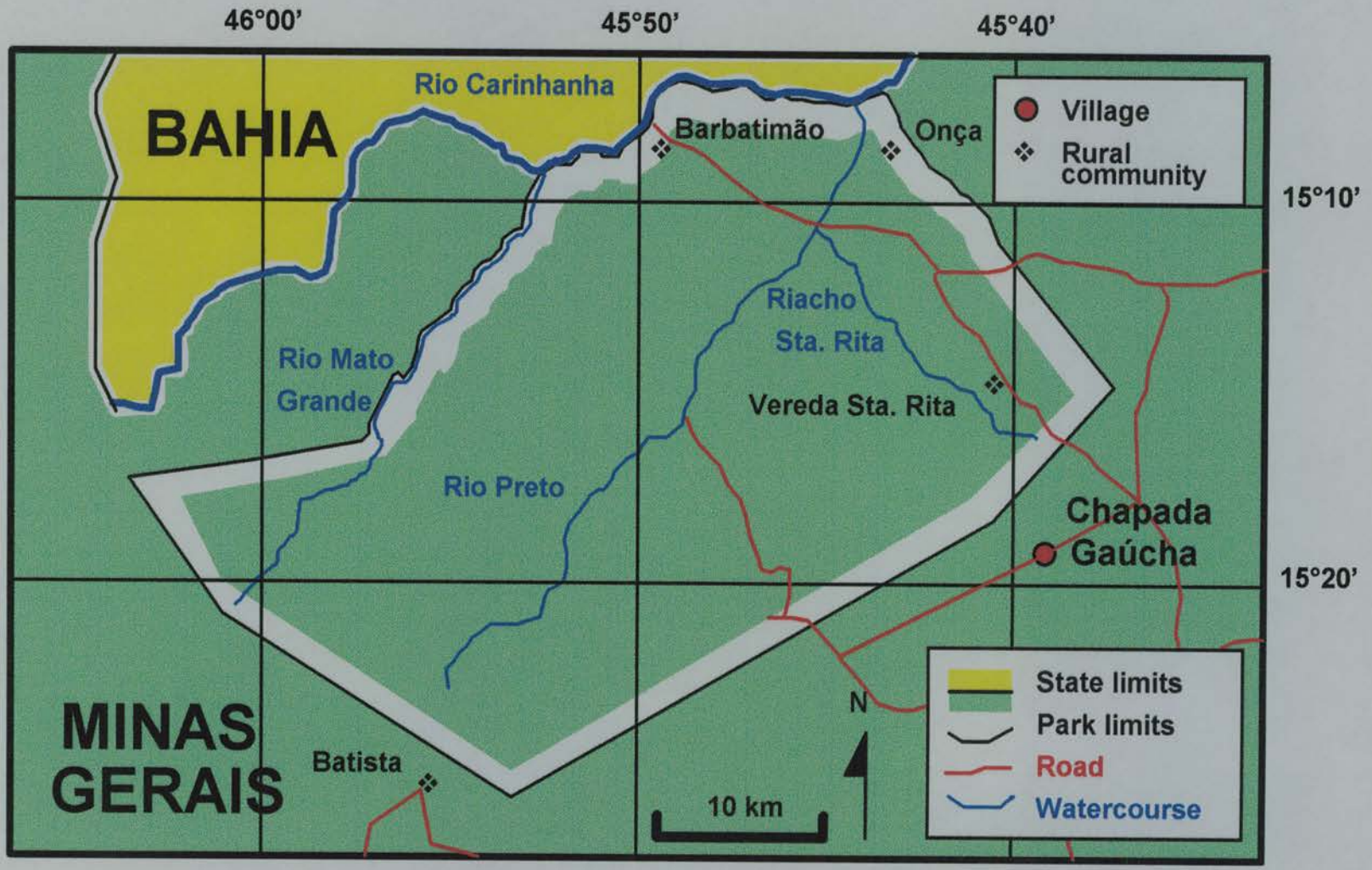

Figure 3.6. Map of the Grandes Sertões Vereda National Park and associated human settlements.

Typical woody cerrado species are *Vellozia flavicans*, *Kielmeyera coriacea*, *Caryocar brasiliense*, *Qualea parviflora*, *Qualea grandiflora* and *Vochysia rufa*, in campo sujo, *Maprounea guianensis*, *Davilla elliptica*, *Bauhinia dumos*, *Copaifera oblongifolia*, *Ouratea hexasperma*, *Pouteria ramiflora*, *Eugenia dysenterica*, *Caryocar brasiliense*, *Qualea parviflora* and *Qualea grandiflora*, in cerrado *sensu stricto*, and *Hirtella glandulosa*, *Hirtella gracilipes*, *Ocotea spixiana* and *Nectandra lanceolata*, in cerradão. Veredas are characteristically covered by a grassy layer where the predominant families are Cyperaceae, Eriocaulaceae and Gramineae; they also have elegant palmeries with *Mauritia flexuosa* and *Mauritiella armata*. Typical gallery forest species are *Xylopia emarginata*, *Callophylum brasiliense*, *Copaifera langsdorffii*, *Myracrodruon urundeuva*, *Chrysophyllum* sp. and *Cupania vernalis* (FUNATURA, 1989)

There are a large number of animal species in the Park, such as the deer *Mazama gouazoubira* and *Ozotocerus bezoarticus*, the cuica *Marmosa* sp., the tamarind *Callithrix penicillata*, the tapir *Tapirus terrestris*, the paca *Agouti paca*, the howler monkey *Allouata caraya*, the collared anteater *Tamandua tetradactyla* and the seriema *Cariama cristata.*

3.5. Results

In general, the partial and overall matrices of Environmental Impact Assessment on the National Parks of Minas Gerais (Tables 3.7–3.22) indicate that cattle raising, agriculture, fire and timber exploitation are the human activities associated with the highest disturbance levels on the protected ecosystems. According to the total scoring of environment impact assessment (bottom right of Tables3.19–3.22) the most seriously affected National Parks are Caparaó (812.7) and Grandes Sertao Veredas (643.7), followed by Serra da Canastra (586.7) and Serra do Cipó (498.0).

In the National Park of Serra da Canastra (Fig. 3.7), (hereafter Canastra), the five main sources of environmental impacts are, on a decreasing order of overall scoring, cattle raising, agriculture, fire, pesticides and timber exploitation (Table 3.19). There is some variation in the scores ranking among the three settlements. In São José do Barreiro, mining (diamond) is the primary impact (Table 3.9), while roads reach a much higher ranking (5^{th}) in São João Baptista da Serra da Canastra (Table 3.8). São Roque de Minas follows the same ranking of the overall scores.

The National Park of Serra do Cipó (Fig. 3.8), (hereafter Cipó), has the most serious environmental disturbance brought about by agriculture, fire, cattle raising, tourism and timber exploitation (Table 3.20), in this sequence. Notable differences among the rankings of the three settlements include the first position of tourism in Complexo Turístico (Table 3.12), the relatively higher scoring of timber (4^{th}) and firewood (5^{th}) in Interna (Table 3.10), and pesticides (4^{th}) and tourism (5^{th}) in Entrada (Table 3.11).

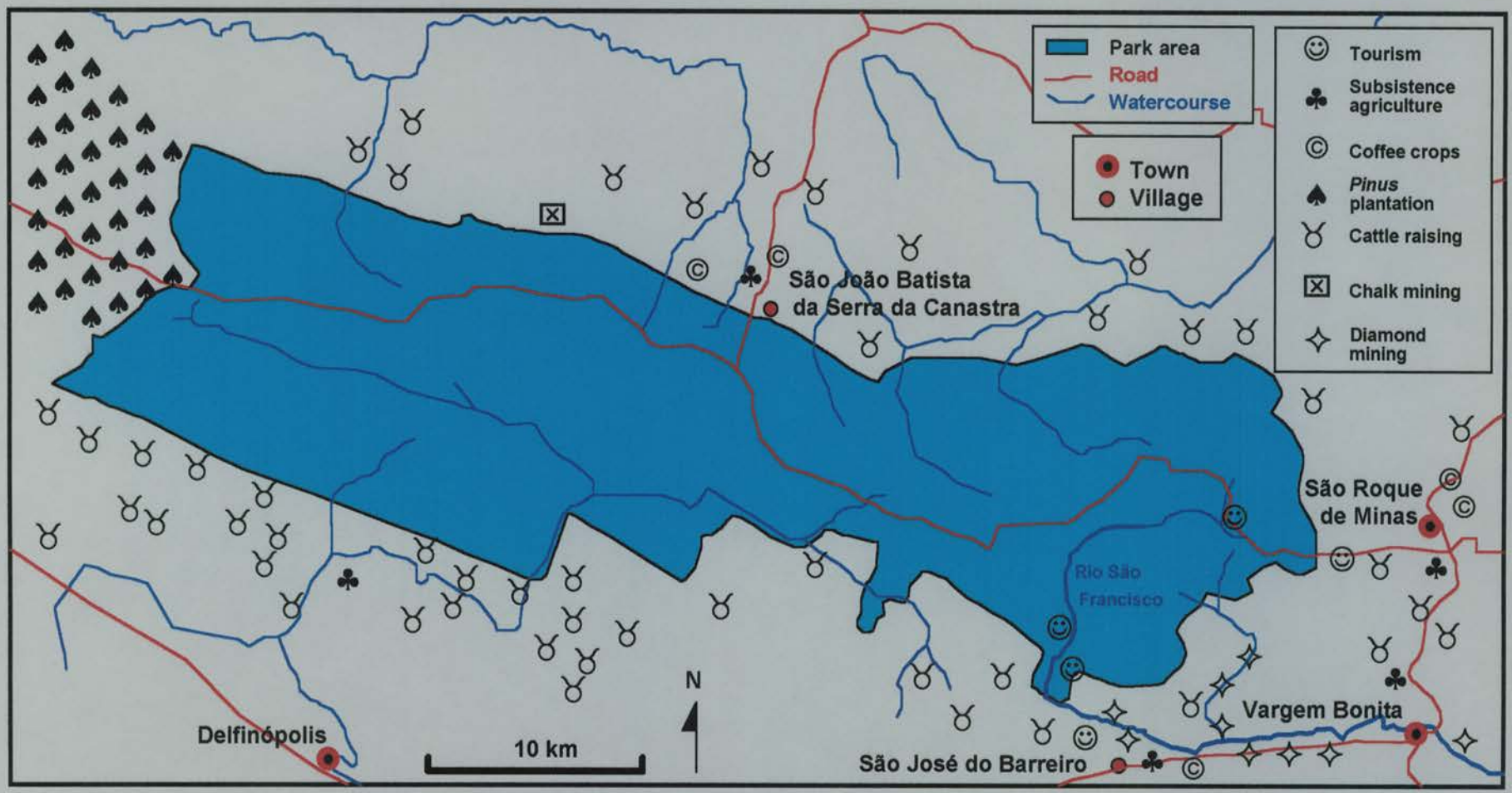

Figure 3.7. Distribution of main socio-economic activities in and around the Serra da Canastra National Park.

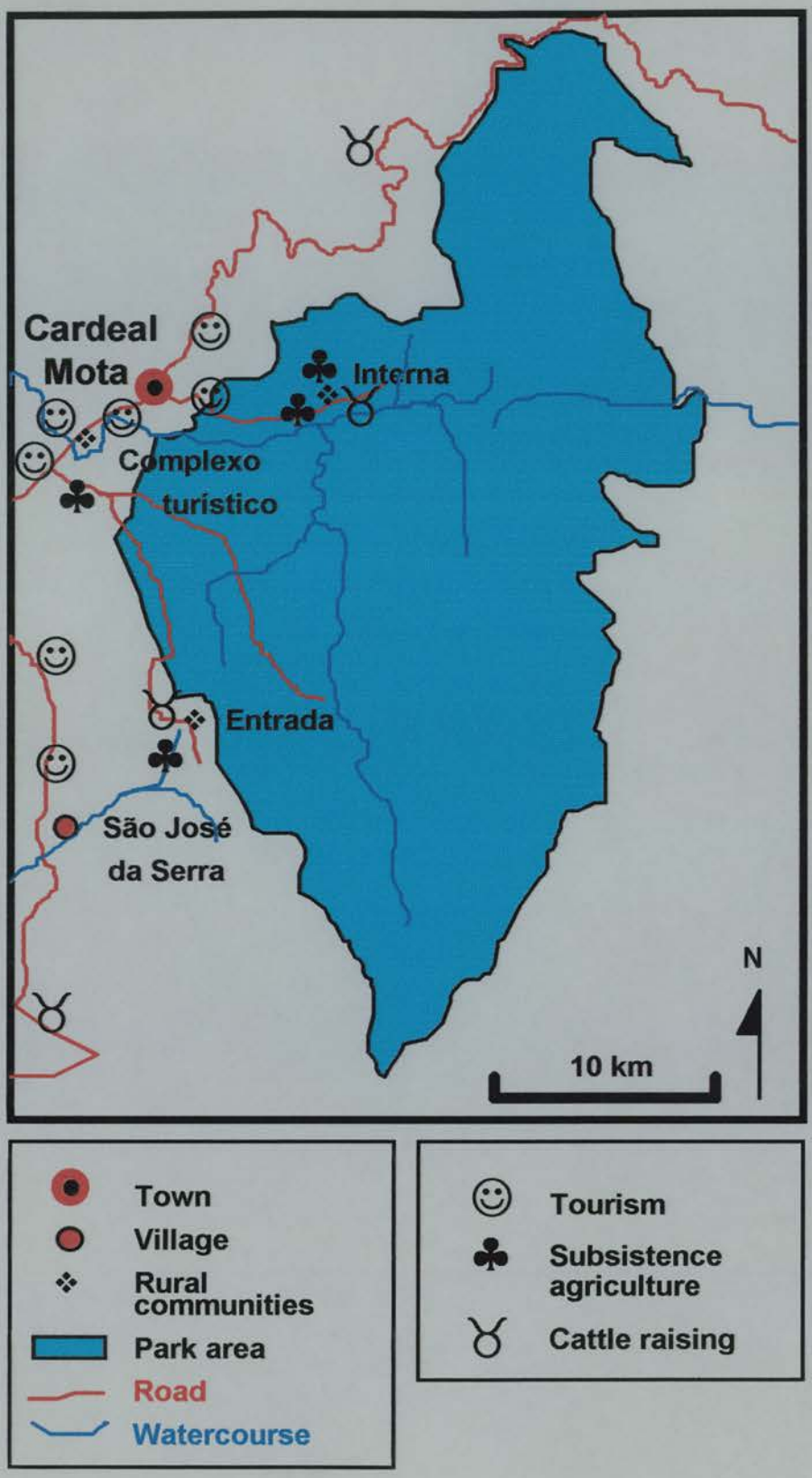

Figure 3.8. Distribution of main socio-economic activities in and around the Serra do Cipó National Park

The main environmental impacts on the National Park of Caparaó (Fig. 3.9), (hereafter Caparaó), are caused by agriculture, cattle raising, fire, reforesting and pesticides (Table 3.21), in this sequence. Differences among the three settlements in relation to the overall scoring include the high ranking of tourism (4^{th}) in Alto Caparaó (Table 3.13), fishery (1^{st}) and extractivism (3^{rd}) in Santa Marta (Table 3.14) and extractivism (5^{th}) in Pedra Roxa (Table 3.15).

In the National Park of Grande Sertão Veredas (Fig. 3.10), (hereafter Veredas), the human activities causing the highest environmental impacts are agriculture, settlement, roads, fire and pesticides (Table 3.22). Chapada Gaúcha stands out from the three settlements with the high scoring of pesticides (2^{nd}) and charcoal (4^{th}) (Table 3.16), whilst in Vereda Santa Rita, extractivism (2^{nd}) and timber exploitation (4^{th}) come to a relatively higher position (Table 3.16). The communities of Barbatimão and Onça score highly with extractivism (1^{st}) and timber exploitation (2^{nd}) (Table 3.17).

Overall impacts on environmental resources showed marked differences among the four National Parks in terms of the human activities involved. Impacts on the water resource, for instance, are mainly related to fishery and reforesting in Caparaó; on settlement, pesticides and agriculture in Veredas; on tourism and agriculture in Cipó; and on diamond mining, pesticides and cattle raising in Canastra (Fig. 3.11-A). The most affected components of the water resource are similar among the Parks (Fig. 3.11-B) with turgidity and increased demand showing the highest overall scorings.

Scoring of the environmental impacts on the atmosphere indicate that fire is the main human activity involved for all four National Parks, although in Veredas the atmosphere is also affected by agriculture, pesticides, and charcoal production (Fig.

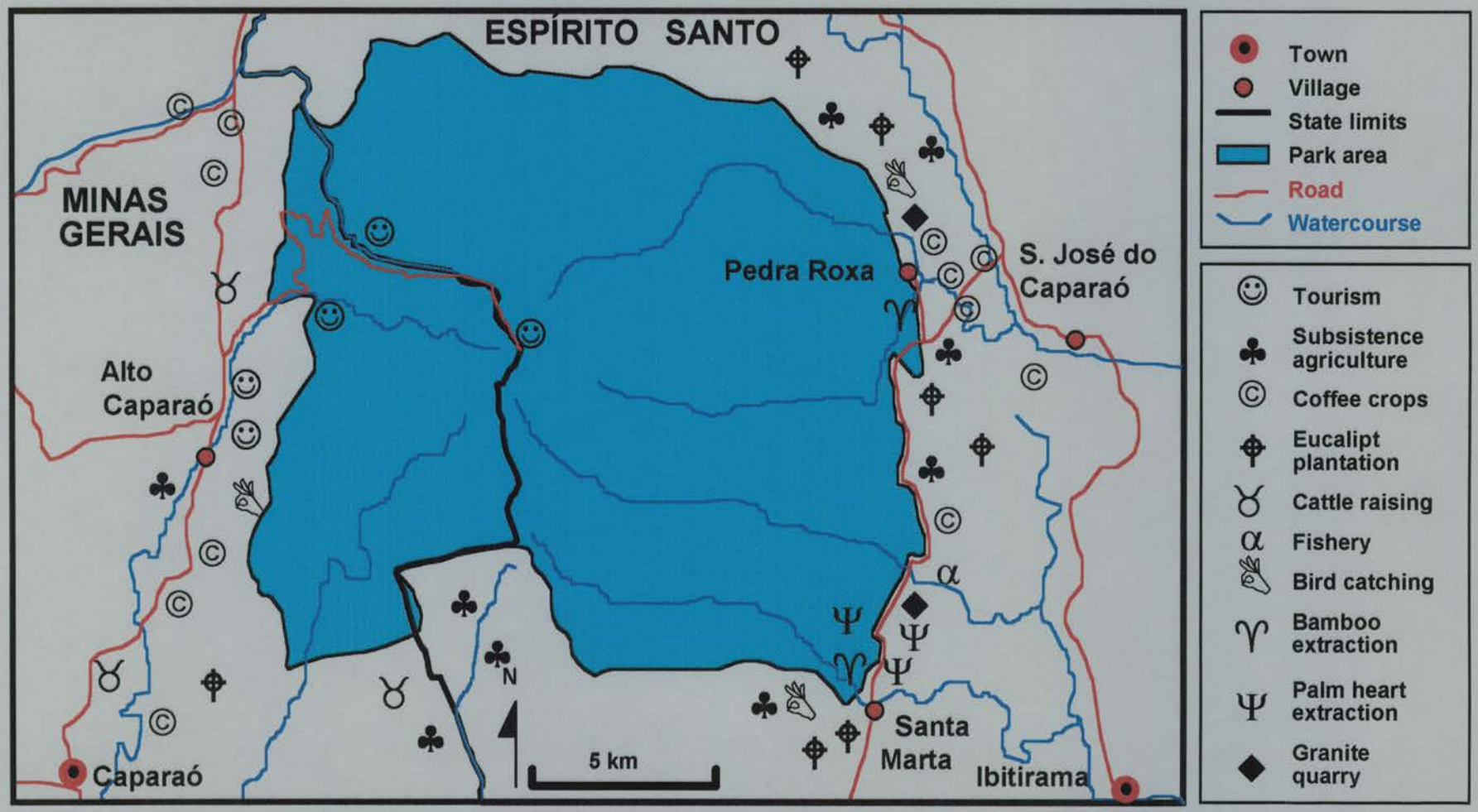

Figure 3.9. Distribution of main socio-economic activities in and around the Caparaó National Park.

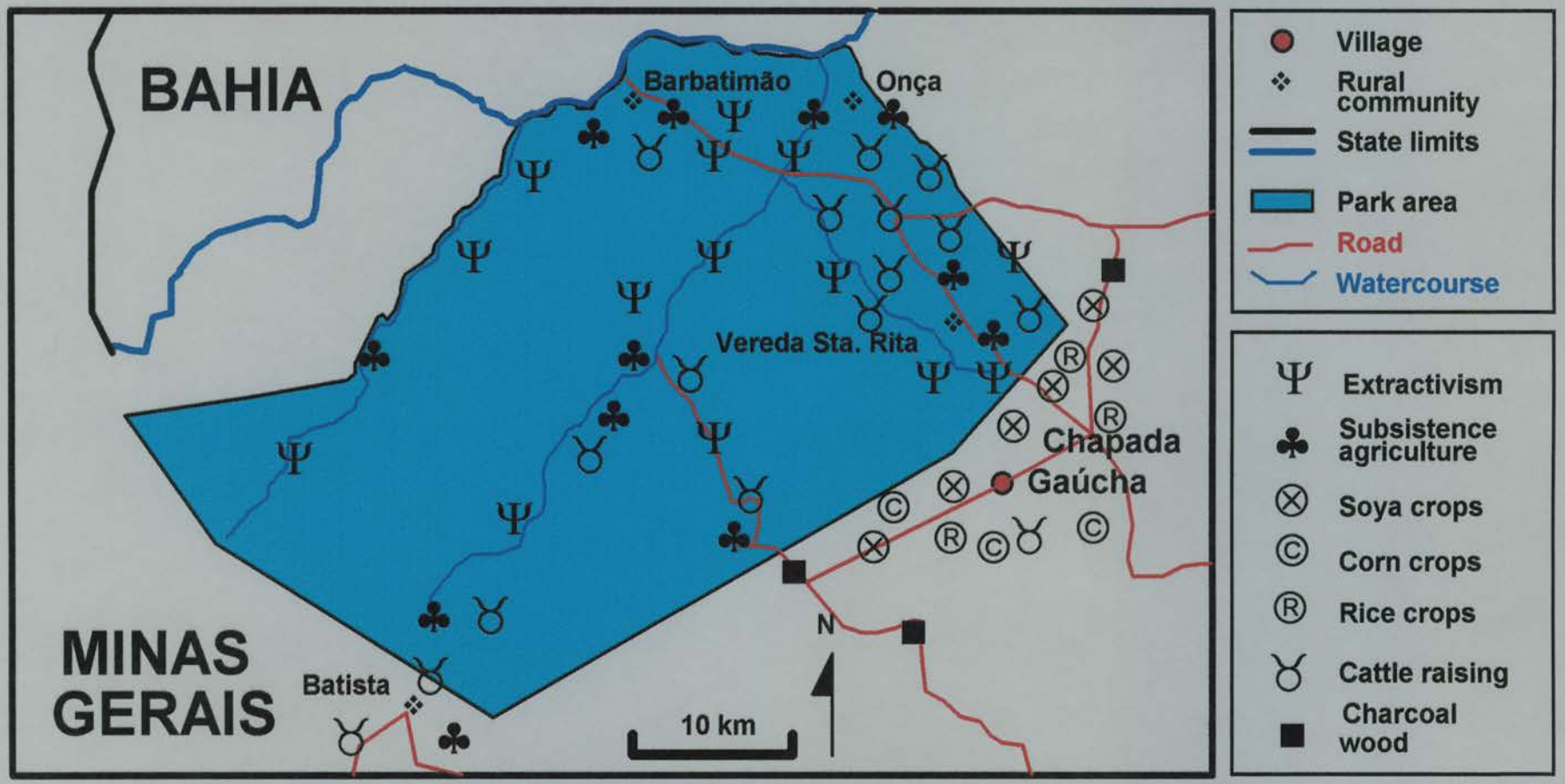

Figure 3.10. Distribution of main socio-economic activities in and around the Grandes Sertões Vereda National Park.

3.12-A). As can be expected, smoke is the most affecting component of the atmosphere.

For the soil resources, the scoring of environmental impacts indicate that agriculture, cattle raising, roads, reforesting, timber and firewood are the main human activities involved for all Parks (Fig. 3.13-A). The results provide evidence that the most affected components are nutrient losses, erosion and soil compacting (Fig. 3. 13-B). Nutrient losses are the most serious aspects in Caparaó, followed by Canastra and Veredas; erosion in Caparaó and Veredas; and soil compacting in Caparaó and Veredas.

Impacts to the wildlife resources are mainly related to fire, cattle raising, pesticides, timber exploitation, firewood and roads in all four National Parks, although particularly relevant activities in each Park include settlement in Veredas; reforesting in Caparaó and Canastra, fishery in Caparaó, and mining in Canastra (Fig. 3.14-A). The most affected component of the wildlife resource is habitat alteration, although food supply and habitat losses are also important in all Parks (Fig. 3.14-B).

Scoring of the environmental impacts to the vegetation indicate that cattle raising, agriculture, fire, pesticides, timber exploitation and firewood extraction are the main human activities involved for all four National Parks, (Fig. 3.15-A). Moreover, vegetation is also highly affected by reforesting in Caparaó and settlement in Veredas. Habitat alteration, biomass reduction, and vegetation cover reduction are the most affected components, although in Caparaó exotic species are also significant (Fig. 3.15-B.).

For the scenic resources, the scoring of environmental impacts indicate that agriculture, fire, roads, timber and firewood extraction are the main human activities

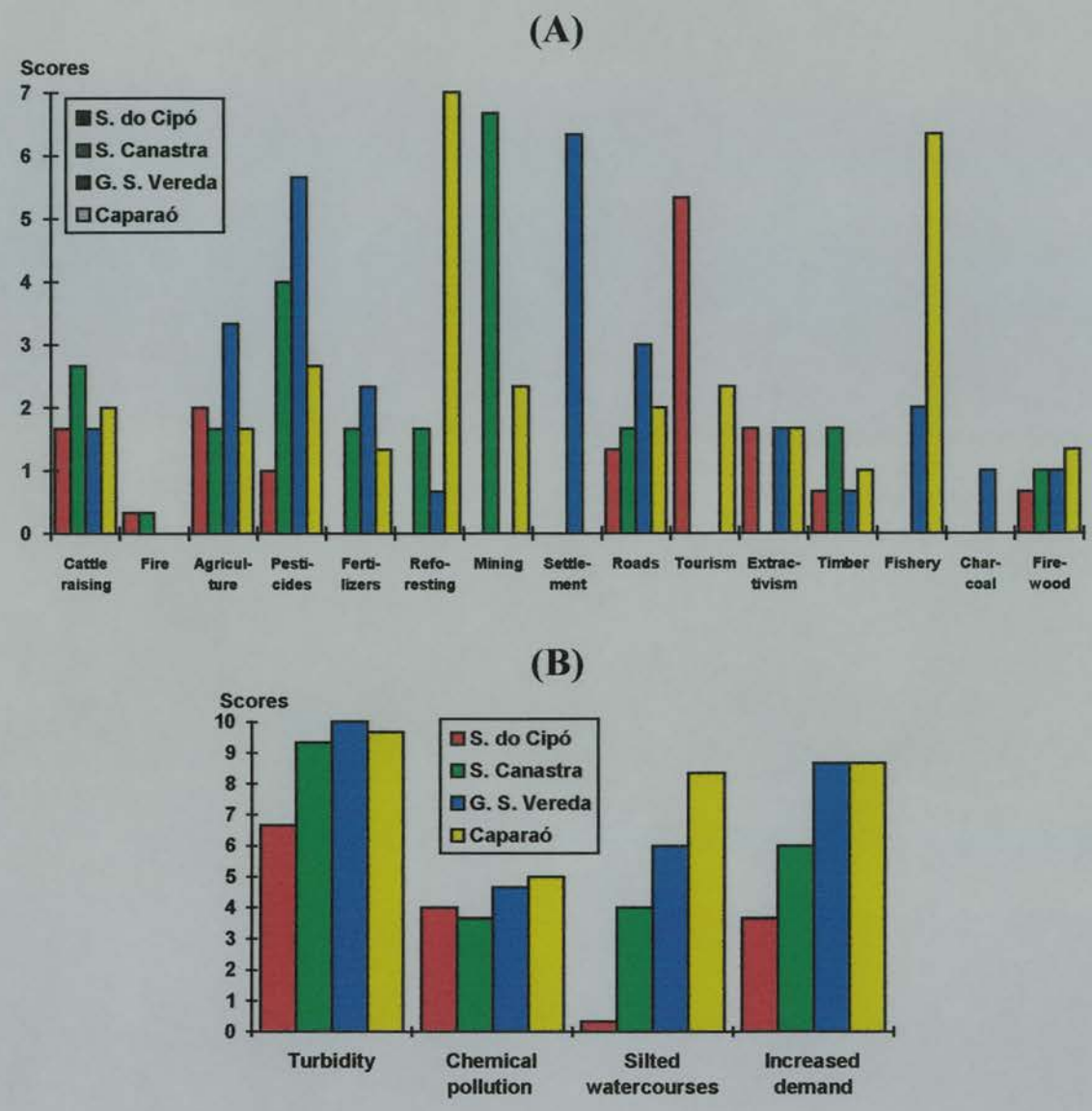

Figure 3.11. Scoring of environmental impacts of the water resource of the four National Parks of Minas Gerais State, Brazil, expressed as total scoring for human activities (A) and environmental components (B). Kendall's coefficients of concordance indicated that agreement among the Parks with respect to the ranked scores was not significant for both human activities ($W = 0.25$, $\chi_r^2 = 14.11$, $P > 0.05$) and environmental components ($W = 0.44$, $\chi_r^2 = 3.50$, $P > 0.05$).

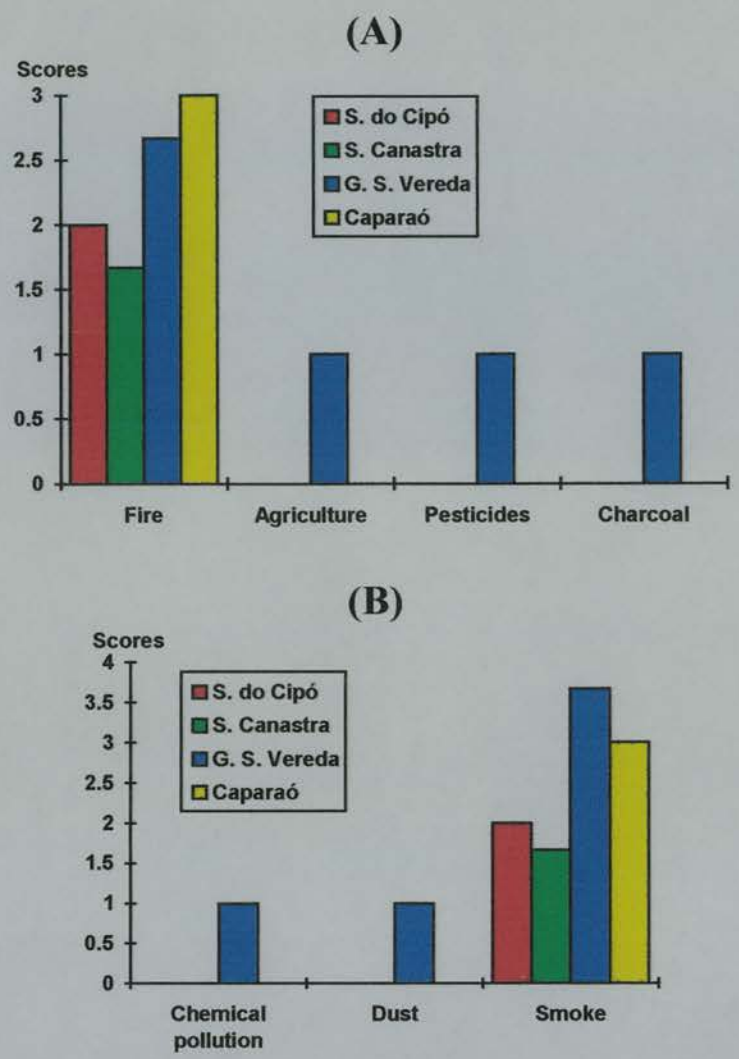

Figure 3.12. Scoring of environmental impacts of the atmosphere of the four National Parks of Minas Gerais State, Brazil, expressed as total scoring for human activities (A) and environmental components (B). Kendall's coefficient of concordance indicated that agreement among the Parks with respect to the ranked scores was not significant for human activities ($W = 0.15$, $\chi_r^2 = 1.80$, $P > 0.05$). The test is not applicable to environmental components (low n value).

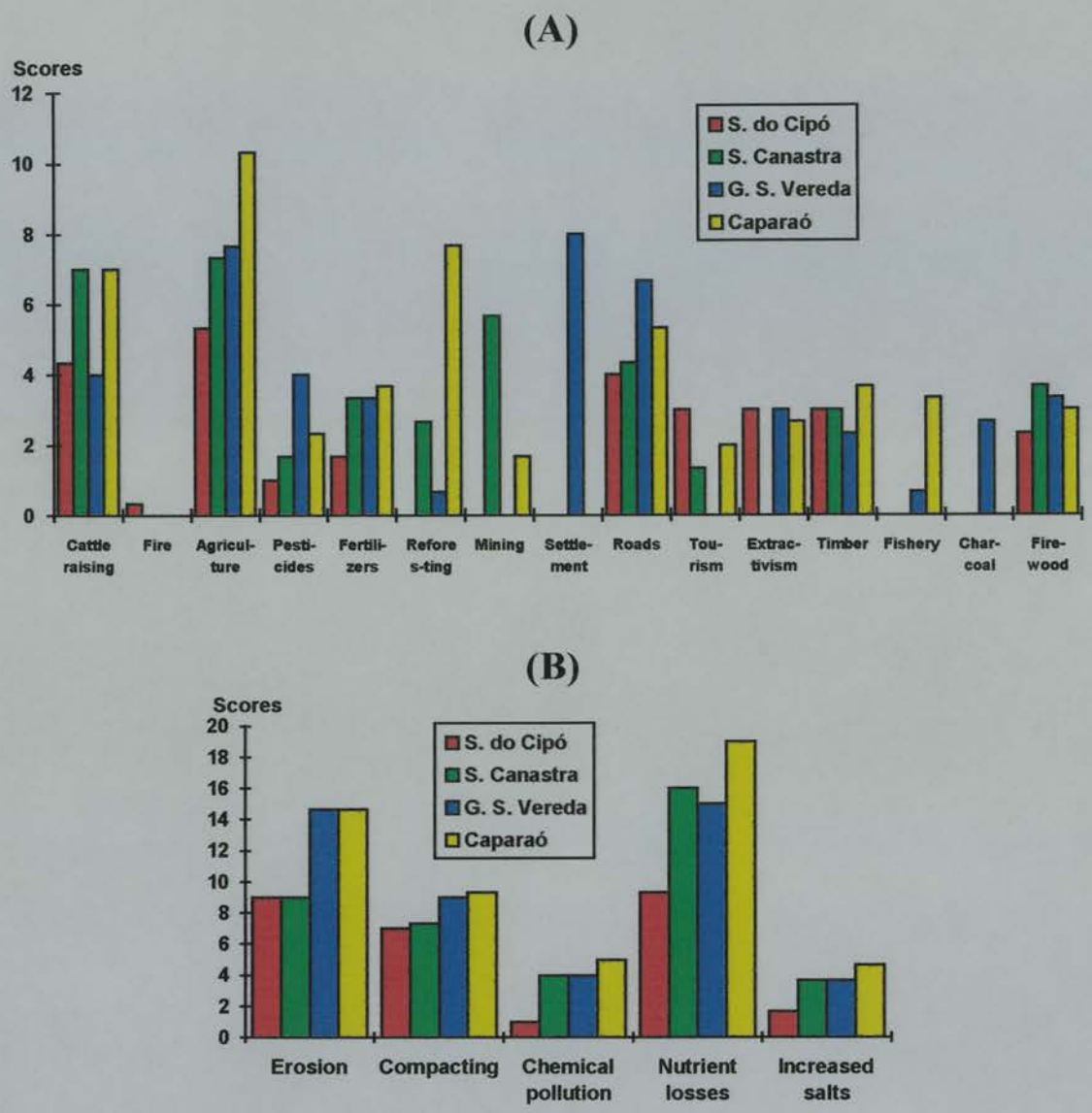

Figure 3.13. Scoring of environmental impacts of the soil resource of the four National Parks of Minas Gerais State, Brazil, expressed as total scoring for human activities (A) and environmental components (B). Kendall's coefficients of concordance indicated that agreement among the Parks with respect to the ranked scores was significant for both human activities ($W = 0.46$, $\chi_r^2 = 25.87$, $P < 0.05$) and environmental components ($W = 0.92$, $\chi_r^2 = 11.10$, $P < 0.001$).

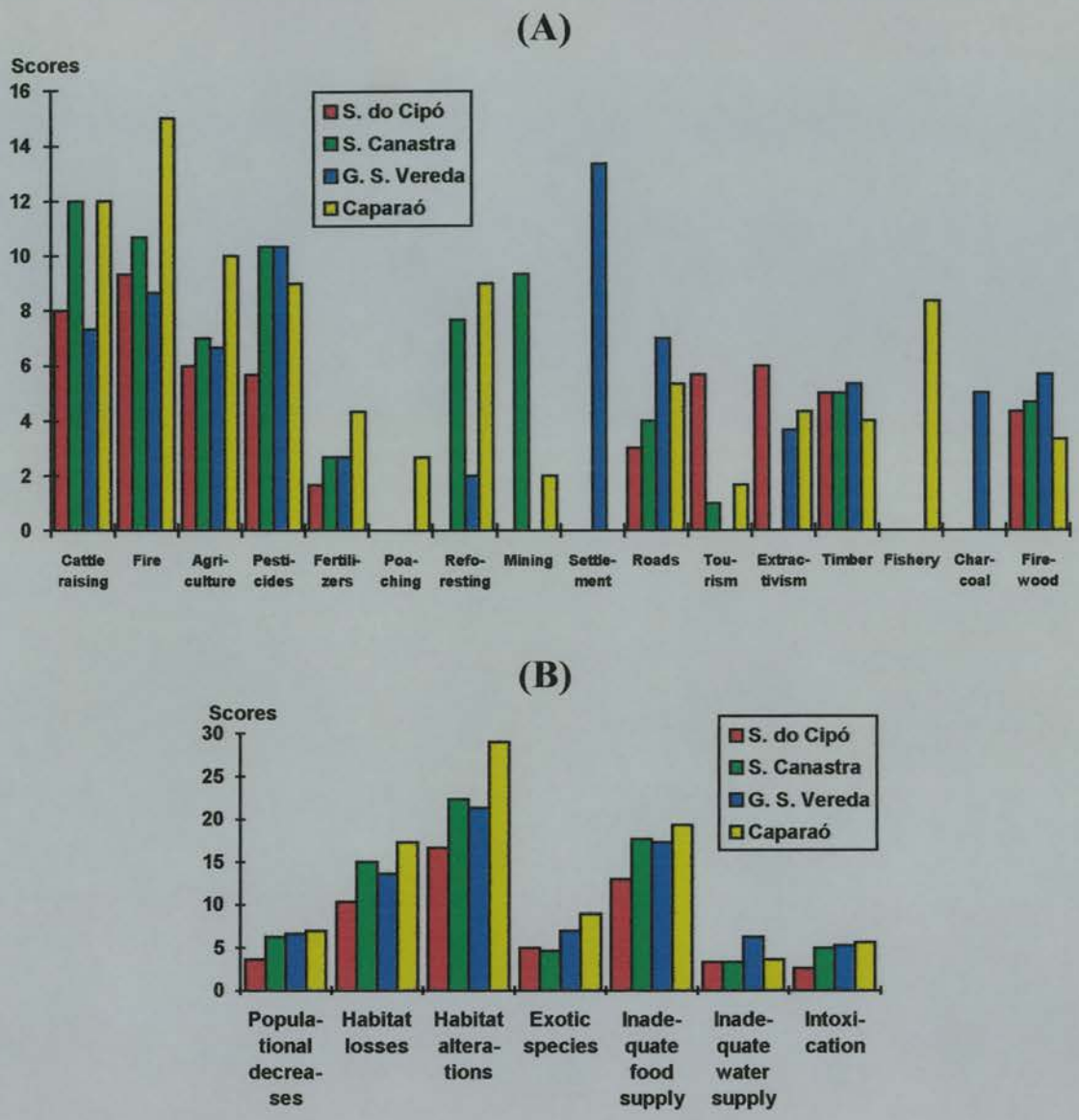

Figure 3.14. Scoring of environmental impacts of the wildlife resource of the four National Parks of Minas Gerais State, Brazil, expressed as total scoring for human activities (A) and environmental components (B). Kendall's coefficients of concordance indicated that agreement among the Parks with respect to the ranked scores was significant for both human activities (W = 0.47, χ_r^2 = 28.06, P < 0.025) and environmental components (W = 0.94, χ_r^2 = 11.71, P < 0.001).

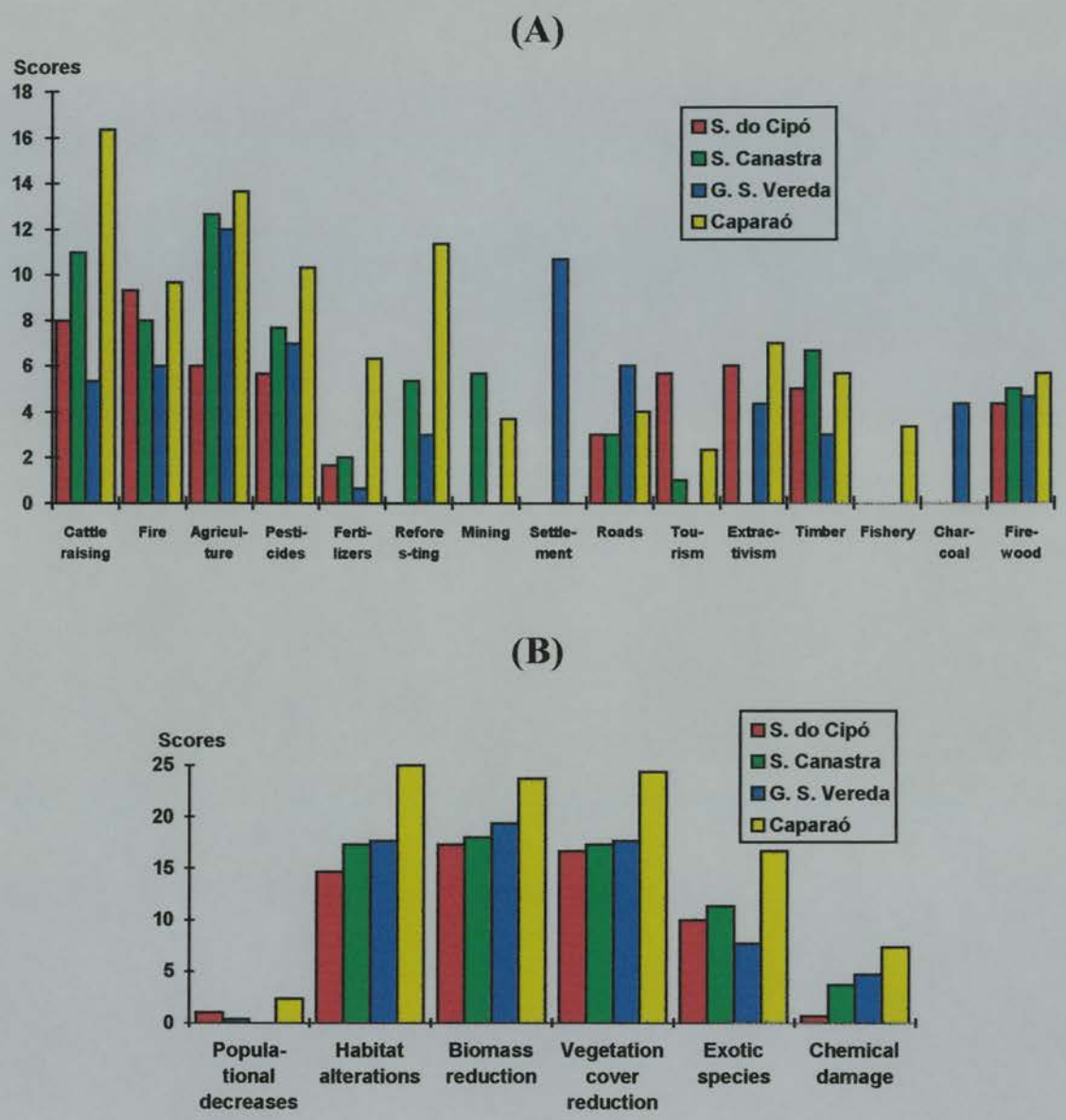

Figure 3.15. Scoring of environmental impacts of the vegetation resource of the four National Parks of Minas Gerais State, Brazil, expressed as total scoring for human activities (A) and environmental components (B). Kendall's coefficients of concordance indicated that agreement among the Parks with respect to the ranked scores was significant for both human activities ($W = 0.52$, $\chi_r^2 = 29.14$, $P < 0.001$) and environmental components ($W = 0.88$, $\chi_r^2 = 14.08$, $P < 0.001$).

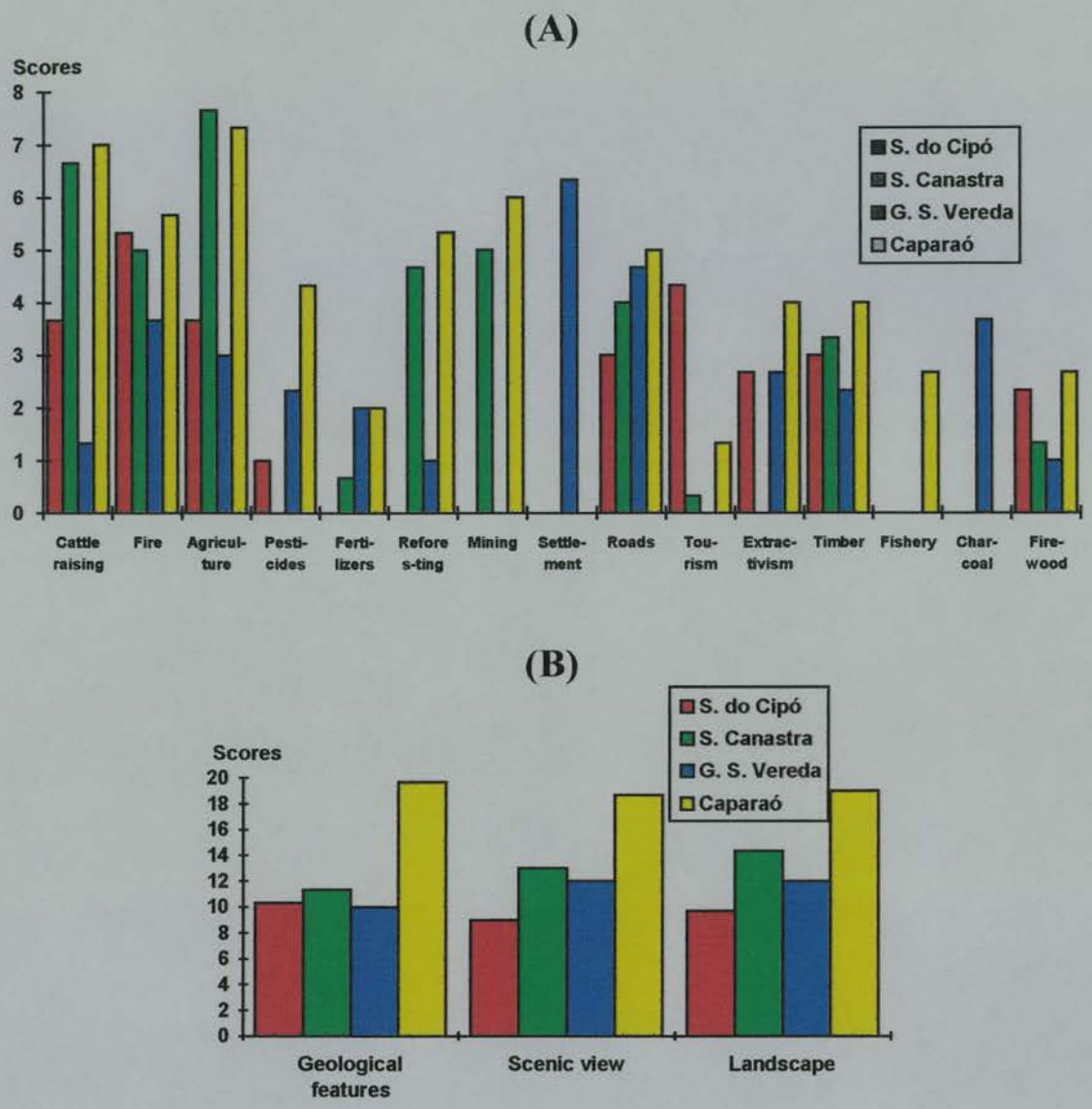

Figure 3.16. Scoring of environmental impacts on scenic resources of the four National Parks of Minas Gerais State, Brazil, expressed as total scoring for human activities (A) and environmental components (B). Kendall's coefficient of concordance indicated that agreement among the Parks with respect to the ranked scores was significant for human activities ($W = 0.34$, $\chi_r^2 = 19.37$, $P < 0.05$). The test is not applicable to environmental components (low n value).

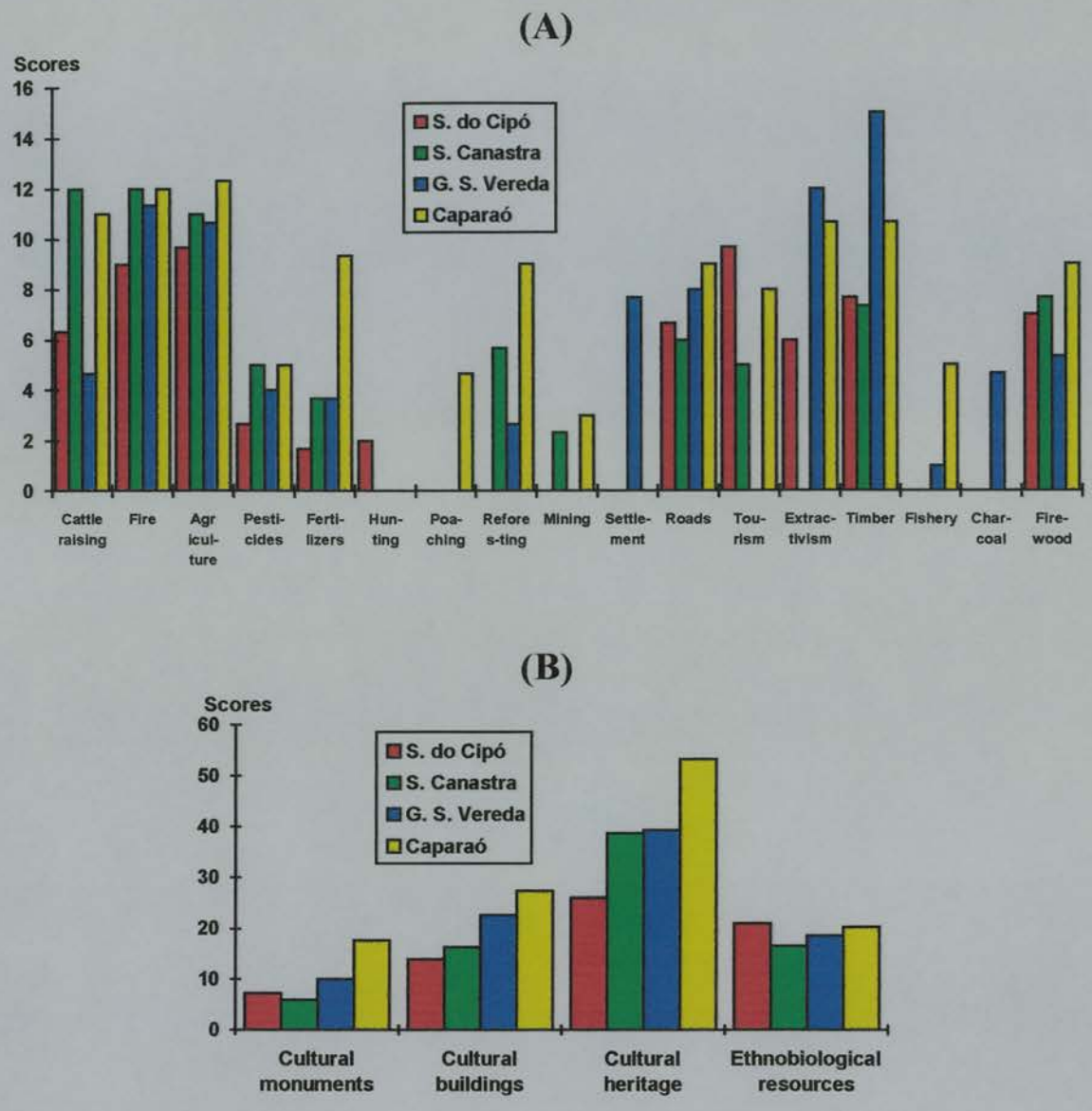

Figure 3.17. Scoring of environmental impacts of the cultural resources of the four National Parks of Minas Gerais State, Brazil, expressed as total scoring for human activities (A) and environmental components (B). Kendall's coefficients of concordance indicated that agreement among the Parks with respect to the ranked scores was significant for human activities ($W = 0.54$, $\chi_r^2 = 34.44$, $P < 0.001$) and non-significant for environmental components ($W = 0.75$, $\chi_r^2 = 6.00$, $P > 0.05$).

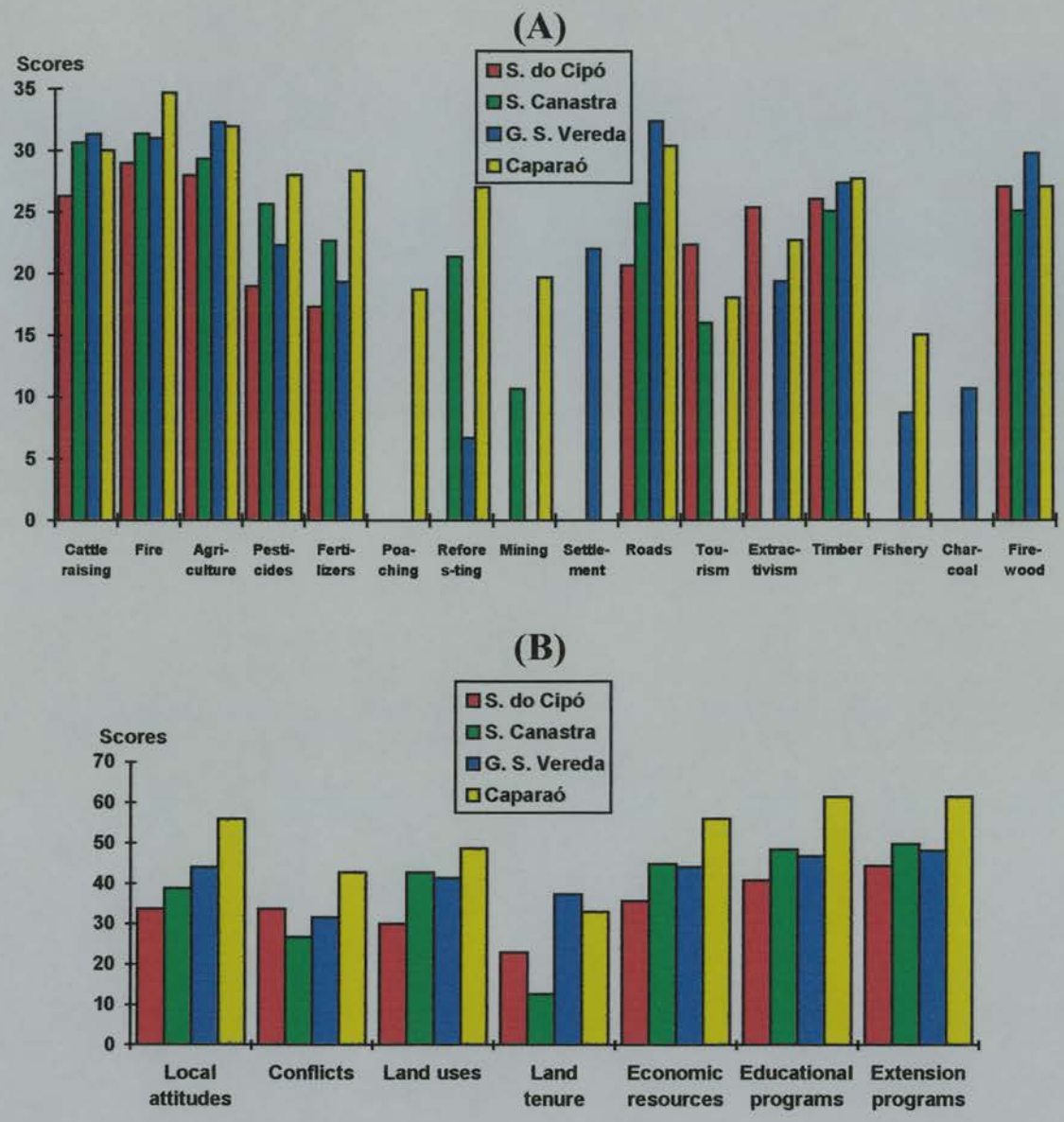

Figure 3.18. Scoring of environmental impacts of the socio-economic resources of the four National Parks of Minas Gerais State, Brazil, expressed as total scoring for human activities (A) and environmental components (B). Kendall's coefficients of concordance indicated that agreement among the Parks with respect to the ranked scores was significant for both human activities ($W = 0.65$, $\chi_r^2 = 38.88$, $P < 0.001$) and environmental components ($W = 1.00$, $\chi_r^2 = 19.92$, $P < 0.001$).

involved in all National Parks (Fig. 3.16,A). The results also indicate that particularly relevant activities in each Park are settlements, extractivism and charcoal in Veredas; mining and reforesting in Caparaó and Canastra; and fishery and pesticides in Caparaó. Too few items in the environmental components do not allow major inferences (Fig. 3.16-B).

Main impacts on the cultural resources are related to agriculture, fire, cattle raising, timber exploitation, extractivism, firewood and roads in all National Parks, although particularly relevant activities in each Park include fertilisers, reforesting, fishery and poaching in Caparaó; and settlement and charcoal in Veredas (Fig. 3.17-A). There is no significant difference among the Parks in terms of cultural resource components (Fig. 3.17,B).

Scoring of environmental impacts on the socio-economic activities indicate that cattle raising, fire, agriculture, pesticides, fertilisers, roads, timber exploitation, and firewood extraction are the main activities involved for all National Parks (Fig 3.18-A). Tourism is particularly relevant in Cipó, Caparaó and Canastra; extractivism in Veredas, Caparaó and Cipó; mining and reforesting in Canastra and Caparaó; and settlement and charcoal in Veredas. Extension and educational programmes, followed by economic resources, are the most affecting components, although local attitudes, land use, conflicts and land tenure issues are also important, particularly in Veredas (Fig 3.18-B)

3.6 Summary

Initially it is important to mention that most human activities in the villages in and around the national Parks of Minas Gerais are traditional, with the exception of pesticides in Grande Sertao Veredas and fisheries in Caparaó.

The human activities should be monitored by IBAMA in order to minimise the effects of these activities on the natural resources. However, IBAMA do not have programs designed to assist these communities and act to punish those who break the law, without regard to the socio-economic situation.

In the next chapter an analysis is given of the main economic activities in the villages in and around the National Parks. This will focus upon the Parks with high scores of Environment Impact Assessment: National Park of Caparaó and National Park of Grande Sertão Veredas. The social impact of the establishment of these Parks will also be analysed in the next chapter.

CHAPTER 4

Agricultural production within village communities close to the National Park of Caparaó.

This chapter is organised into two main sections. The first section examines the structural characteristics of agricultural production in the settlements of Santa Marta, Pedra Roxa and Alto Caparaó, whilst the second identifies the categories of rural producers. As indicated in the previous chapter there are different groups of rural producers who live around the National Parks, each having a different relationship with the National Parks. The main purpose of this chapter is to analyse these categories and, for each village, to assess the relationship between rural producers and the Park.

4.2. Santa Marta Village

Santa Marta is located in the Northern region of Ibitirama and is the main village neighbouring the Caparaó National Park. At present the main economic activities in Santa Marta are the production of coffee, cattle raising, forestry and farming for subsistence crops such as beans, rice, corn and manioc. The most recent economic activity in the vicinity of Santa Marta is a large trout farm in the Caparaó basin.

The nature and significance of each of the main economic activities in Santa Marta will be now examined:

a) Coffee production has been the most dominant economic activity in the state of Espirito Santo. Coffee was introduced into the Serra do Caparaó towards the end of last century, with the arrival of immigrants, especially Italians and Germans. According to Schitini (1992), the region was occupied in small tracts allocated to the immigrants by the state authorities. Each tract was approximately 30 ha and was sold with a 5-year mortgage. This form of occupation developed the area into a landscape of small properties, and led to diversification of crops, intensive exploitation of land by the landowners and sharecroppers, and promoted rapid demographic expansion in the region. This pattern of land occupancy can still be observed today in and around Santa Marta.

In the sixties, coffee contributed to 30% of the income in Espirito Santo state. Moreover a governmental plan for revitalisation of coffee crops between 1960-1962 and 1970-1972 improved conditions for cultivating coffee in the Caparaó region. As a result of this policy, credit was widely available and the production of selected seedlings improved together with the promotion and purchase of equipment. Thus improvements in coffee production can be traced to this sale and greater use of technical inputs (FASSARELA, 1987).

At present, most of the coffee is of the Arabic (*Coffea arabica*) variety and the coffee is planted by different categories of rural producers. According to EMATER (1995) most of the coffee produced in Santa Marta is of low quality and supplies the internal Brazilian market. Only 10% of the crop is of sufficient quality to be exported. The crop is also subjected to variations in prices and agricultural policies, which have a pronounced effect on the regional economy.

b) The second main crop in the Santa Marta region is *Eucalyptus*. In the 1960's the military dictatorship provided fiscal incentives to promote reforestation and to encourage wood production as a fuel for the steel industry. Between 1967 and 1986, 6.5 millions of ha of *Pinus* and *Eucalyptus* were planted in Brazil.

The crisis affecting coffee production at the beginning of the sixties forced the Espirito Santo State government to stimulate industrial investment with the aim of diversifying the economy. Moreover the favourable characteristics of soil, climate, and close proximity to the ports made Espirito Santo a good option for investment. The introduction of a large enterprise called Aracruz cellulose in Espiríto Santo state in the sixties formed part of an increase in investments to produce and export cellulose to international markets. Investment in cellulose transformed Minas Gerais, Espiríto Santo and Bahia into a "sea of cellulose"(FASE , 1992).

Currently there are two projects concerned with *Eucalyptus* production in Espirito Santo. The first is the Project of Fomentation and Forestry Extension in Medium and Small rural Properties (Projeto de Fomento e Extensão Florestal em Medios e Pequenos Imoveis Rurais) promoted by EMATER. The main aim of this project is to reduce the destruction of Atlantic Rain Forest resulting from increasing demands for forest products, and to conserve the soils and biological diversity of the region through the growing of forest species with economic potential.

A second project is the Programme of Forest Development (Programa de Fomento Florestal) promoted by Aracruz Florestal. This project offers a new initiative promoted by Aracruz cellulose to expand the Aracruz activities to medium and small farmers. The programme represents a total integration of the rural producers into the agro-industrial complex developed by the Aracruz company. In

this way the company hopes to transfer technology to small and medium farmers whilst guaranteeing a market for their produce. However, there are some points that need to be carefully analysed a) the production of *Eucalyptus* is in a mono-cultural form, b) the market prices are controlled by Aracruz and c) the difficulties of targeting the markets for other crops given the highly specific nature of mono-culture, all of which cause enormous problems for small farmers (FASE, 1992). Further more, there is no insurance against pests and diseases, and eucalyptus production is worthless after the second cut. As a result, the small farmers linked to Aracruz will have great difficulties to produce after the second cut.

Due to further coffee crises of the last decade, many farmers in Santa Marta have now dedicated themselves to *Eucalyptus* production. Some farmers have small areas producing eucalyptus integrated within the farm but others have dedicated a large proportion of their lands to *Eucalyptus* in order to supply the Aracruz cellulose operations. These farmers maintain coffee crops on the flatter and better areas and utilise areas with irregular relief for Eucalyptus production. Aracruz funded the plantations through instalments at different stages in the reforestation process. These stages included preparation of soil, planting, clearance, fertilisation and harvesting. The instalments are also used to pay for the inputs used in the coffee plantations, mainly fertilisers, which are the most expensive and essential inputs to coffee production in the Caparaó region.

Despite the drawbacks of the contracts that many farmers now have with Aracruz, it appeals to the insecure livelihoods of small farmers in the region due the seasonality of coffee crops and the lack of a consistent agricultural policy for small farmers throughout Brazil.

c) Cattle raising in Santa Marta is an activity that has been eclipsed by coffee production despite its importance. Most farms have a small herd of dairy and beef cattle that supply the farm and represents a capital reserve for the producer.

There are few areas of natural pastures in Santa Marta thus the farmers utilise newly created areas of pasture in the mountains. This is principally due to difficulties of using these areas for coffee. To create pastures, the farmers clear areas of natural native vegetation using strong herbicides and subsequently plant pastures normally as *Brachiaria* or *Paspalum spp.* Another system for increasing the area of pastures is to burn native vegetation and plant pasture grasses before regeneration of native species. Fire is also the main tool used by these farmers for the biannual cleaning of the natural pastures in regions of Caparaó. Every two years, before the rainy season, the farmers set fire to the pastures as a way of eliminating unwanted weeds.

d) According to FASSARELA (1987) subsistence crops, such as beans, corn and manioc are cultivated between the coffee crops with any excess production being sold.

Beans are traditionally cultivated for human consumption although sometimes they are used as goods exchange, or as payment for services such as cleaning of pastures. Corn is produced mainly for human consumption, but it is also converted to corn flour for animal feed, particularly livestock such as pigs and chickens. Manioc is used all over the region and is primarily eaten as root or flour or made into animal feed.

4.3. Socio-economic characterisation of rural producers in the village of Santa Marta

Using the 8 variables described in the previous chapter, interviewees were classified into 4 categories. The main objective is to describe the general characteristics of each category in terms of size, annual Gross Value of Agricultural Production (GVPA), Gross Value of Commercialised Production (GVPC), type of labour, other economic activities, level of schooling, use of industrialised inputs and use of machinery.

4.3.1.Peasants

This category is composed of just 3 rural producers who can be called peasants. The properties are small, less than 50 hectares, and are located in the highlands of Santa Marta Village close to the borders of the National Park of Caparaó.

These rural producers have a small Gross Value of Agricultural Production (GVAP), of less than US$ 1000 per year Table (4.1). Coffee is produced for market and subsistence crops are grown, such as corn and beans. One rural producer has a contract to produce *Eucalyptus* for Aracruz cellulose providing a way to pay the cost of fertilisers used for the coffee crops.

All producers in this category have a Gross Value of Commercialised

Table 4.1. Socio-economic categories of rural producers of Santa Marta state of Espirito Santo GVAP=Gross value of agricultural production; GVCP=Gross value of commercialised production; TFL= Total family labour; TLP = Total labour of the property.

Variables	Socio-economic categories									
	A (N=)3		B (N=)7		C (N=)10		D (N=)4		Total (N=24)	
	n	N/n %	n	N/n %	n	N/n %	n	N/n %	n	N/n %
Property area (ha)										
< 50	3	100	6	85.8	9	90	2	50	20	83.3
50 — 100	-	-	1	14.3	1	10	-	-	2	4.17
100 — 500	-	-	-	-	-	-	2	50	2	8.33
500 — 1 000	-	-	-	-	-	-	-	-	-	-
1000 —5000	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
GVAP - US$										
< 1000	3	100	-	-	-	-	-	-	2	8.33
1000 — 6000	-	-	7	100	-	-	-	-	8	33.3
6000 — 18000	-	-	-	-	10	100	-	-	10	41.7
> 18000	-	-	-	-	-	-	4	100	4	16.7
GVCP/GVAP										
< 50 %	-	-	-	-	-	-	-	-	1	4.17
50 — 60%	-	-	-	-	-	-	-	-	-	
60 — 80%	-	-	-	-			1	25	1	4.17
> 80%	3	100	7	100	10	100	3	75	22	91.7
TFL/TLP										
< 40%	1	50	4	57.2	3	30	2	50	12	50
40 — 55	-	-	-	-	1	10	2	50	3	12.5
55 — 70	-	-	2	28.6	2	20	-	-	3	12.5
> 70	2	50	1	14.2	4	40	-	-	6	25
Other activities										
Yes	2	66.6	4	71,0	3	30	1	25	11	45.8
No	1	33.3	3	28.6	7	70	3	75	13	54.2
Schooling level										
No Schooling	-	-	-	-	2	20	-	-	3	12.5
Primary	1	33.3	7	100	8	80	4	100	20	83.3
Secondary	2	66.6	-	-	-	-	-	-	1	4.17
University	-	-	-	-	-	-	-	-	-	
Inputs										
Fertilisers	3	100	7	100	10	100	4	100	24	100
Selected seeds	-	-	5	71.0	5	50	3	75	13	54.2
Pesticides	1	33.3	3	57.2	4	40	1	25	8	33.3
Vaccines	-	-	1	14.3	2	20	2	50	5	20.8
Animal Feed	-	-	-	-	-	-	-	-	-	
Seedling	2	66.6	5	71.0	5	50	1	25	11	45.8
Machinery										
Possesses	-	-	-	-	1	10	-	-	1	4.17
Rents	-	-	-	-	2	20	1	25	3	12.5
Does not use	2	100	7	100	7	70	3	75	20	83.3

Source: based on field survey 1995

production (GVCP) above 80% Table (4.1). They produce fewer than 5 sacks of coffee per year and the production is sold through local "*compradores de cafe*"(coffee buyers). These "*compradores de cafe*" are also coffee producers who buy the production of other farmers and sell it in the neighbouring cities of Guaçui and Iuna.. These dealers pay the farmers in advance, thus allowing them to purchase the necessary inputs and to pay for the labour needed at harvest time. All trade deals are made in a currency of sacks of coffee and outstanding debts are often carried forward to the next year.

Two of these farmers use family labour exclusively whilst others use a system of sharecropping. The landowner gives the land, coffee plants and half of the inputs whilst the sharecroppers provide the remaining inputs and all the labour necessary for coffee production.

One rural producer in this category has no other form of economic activity and the property is the only source of income for the family. The other producers have supplementary economic activities; one is a librarian in a State School and the third is a civil servant. There are no illiterate producers in this category. One has a primary school education and the others reached a secondary level.

The main input used by the farmers is fertiliser because the coffee crops demand a high level of fertilisation (20-5-20). The seasonality of coffee crop markets, and the fluctuation of prices has led to the small farmers abandoning coffee crops during some periods. For instance, at certain times the price of a sack of coffee was equivalent to two and half sacks of fertiliser. In 1993-1994 coffee prices increased and in1995 a sack of coffee was equivalent to nine sacks of fertiliser, so the farmers were again able to afford fertilisers in the coffee plantations. They do not

use fertiliser in the cultivation of subsistence crops due the high cost and low value of the produce and the difficulties of marketing.

The rural producers in this category do not use machinery on their properties due to the nature of the relief and costs. Thus all labour requirements must be carried out manually.

4.3.2. Family Farmers

Seven producers fall within this category. Nearly 86% of the properties are less than fifty hectares, with one property having an area of between 50 and 100 hectares. All producers have a Gross Value of Agricultural Production (GVPA) of between U$1000 and U$ 6000 per year.

In this category 87.5% of farmers produce for market and the Gross Value of Production Commercialised (GVPC) is over 80% Table (4.1). As in the other categories, coffee is the main crop. In addition 3 rural producers rear and sell livestock, grow fruit and sugar products (*melado* a type of syrup and *rapadura*, raw brown sugar). One sends the vegetable products to Vitoria whilst the others sell the produce themselves in Ibitirama and Santa Marta. There are also a few rural producers who plant Eucalyptus on their property.

Rural producers in this category originally used a combination of family labour and paid labour on their farms to grow the subsistence crops and maintain the livestock. Family labour still predominates in looking after the farms, although for the coffee harvest they contract salaried workers. Some of these farmers also use sharecropping to aid agricultural activities. Many rural producers have also increased

the area planted with coffee and this has led to a large consumption of inputs such as selected seeds, herbicides, insecticides and coffee seedlings. All work necessary for agricultural production is manual both for subsistence and commercial crops.

All producers have a primary education, with four of them supplementing their livelihoods by other forms of economic activity (Table 4.1).

4.3.3. Rural Producers with medium level of income

There are 10 rural entrepreneurs with a medium level of income (Table 4.1). Around 90% of these have properties with sizes varying between 50 and 100 hectares. The Gross Value of Agricultural Production varies between 6000 and 18000 U$ (Table4.1). A significant proportion of the production is destined for market and the Gross Value of Commercialised Production is over 80%. Coffee is the main product, however 2 farmers are also involved in cattle raising, one for milk production and the other in the production of beef. One of these farmers is introducing quarrying as an additional resource on his farm.

Family labour is used for the cultivation of subsistence crops, with salaried workers being employed during the coffee harvest and for cleaning the pastures. Most of the farmers have no additional economic activities, although one rural producer is also *comprador de cafe* and another is vice-mayor. Eight of these rural producers have a primary education and the remaining two are illiterate.

The high degree of diversification of these farmers has resulted in a large consumption of external inputs such as fertilisers, herbicides, vaccines, coffee seedlings, selected seeds and Eucalyptus saplings.

Despite the unfavourable relief, producers use machinery on their properties, one having a small tractor, and the some renting machinery. The remaining farmers do not use machinery.

4.3.4 Rural Producers with high level of income

There are 4 rural producers in this category, all with high levels of income. They have a Gross Value of Agricultural Production (GVPA) above 18000U$ (Table 4.1). Half of these producers have properties smaller than 50 hectares, and the others have properties of between 100 and 500 hectares.

These farmers grow coffee as their main activity, whilst cattle raising provides the main secondary activity. A further two of these farmers have planted Eucalyptus. One has a contract with Aracruz and the other plants Eucalyptus for sale as firewood.

Three of these farmers sell more than 80% of their agricultural production while the others sell between 60% and 80% of their production (Table 4.1).

The farmers use family labour, although they contract salaried labour during crop harvests. One farmer is the owner of a supermarket in Santa Marta. The remainder have no other economic activities. All of the producers have an education up to primary level.

A large number of inputs are utilised on these properties (Table 4.1), such as fertilisers, selected seeds, pesticides, vaccines, coffee and eucalyptus seedlings. There is no consumption of cattle feed since they make use of natural pastures, and provide corn and salt.

All work on these properties is done manually, although farmers use strong herbicides as a substitute for the payment of salaried workers in pasture cleaning.

4.4 Santa Marta and National Park of Caparaó

Santa Marta is a settlement located in a valley surrounded by the mountains of Caparaó and in close proximity to the Santa Marta river. Rural producers of different categories live in Santa Marta because of the facilities such as primary and secondary schools, a small health unit (a doctor visits the village once a week), public transport, supermarkets and small shops, bars, a Catholic church and several Protestant churches of different denominations.

The majority of rural producers in categories A and B have properties in the higher lands neighbouring the National Park; consequently there are many sources of conflict between farmers and the National Park. Firstly, the rural producers use fire to renew the pasture and eliminate the unwanted weeds. Sometimes these fires become out of control, and depending on the climatic conditions can lead to the burning of other farms and hundreds of hectares of protected ecosystems. Secondly, the small farmers lack the income to fertilise the coffee plantations adequately. To compensate for this low productivity, new areas are deforested, forming new coffee and eucalyptus plantations. Thirdly, gneiss quarrying is carried out in different areas of the village, most of which is illegal.

The properties of the farmers in categories C and D are located in the low lands, close to the village. These farmers also produce coffee, plant eucalyptus and

rear cattle, but there is less conflict with the National Park. Fire is used to clean the natural pastures of the region, but the fires do not usually reach the boundaries of the National Park. The farmers are also dependent on the production of coffee, but the plantations have a higher level of productivity due to the improved economic conditions allowing the purchasing of fertiliser. In consequence, new areas do not need to be deforested to increase the production of coffee.

4.5 Pedra Roxa

This section will examine the main socio-economic characteristics of the village of Pedra Roxa.

Pedra Roxa is another district of Ibitirama bordering the National Park of Caparao. Like Santa Marta the main economic activity is coffee production, followed by cattle raising and the production of subsistence crops. In addition, some farmers grow vegetables for themselves and for the local market.

a) Coffee - Pedra Roxa, like Santa Marta, was colonised by immigrants, particularly Germans, Italians and Swedes. Most of the properties are smaller than fifty hectares with coffee production as the main economic activity.

According to Silva (1997), the community of Pedra Roxa developed, beginning in the 1940s, with the expansion of coffee in the *Capixaba* Mountains. The aggressive spread of the coffee plantations affected not only the vegetation of the region but the whole landscape. The coffee was produced on the well-drained higher land, due to the abundance of water in the lower meadows, damaging the roots of the bushes. The farmers cleared the forest with axes, which was followed by firing the

woody litter and planting coffee. With this system of production it took six years to reach the first harvest. There were two main reasons for the expansion of coffee plantations. The first was the presence of good quality land formerly covered by forests on soils of high fertility. The second reason was the possibility that sharecroppers could became owners due to the cheap price of the land. In addition, finance in the form of bank credit was available for buying land.

Coffee is also the main crop associated with a number of subsistence crops. At certain times, the seasonality of coffee and the fluctuation of market prices have led to small-scale farmers abandoning coffee and planting solely subsistence crops. The relationship between market prices of products, and costs of inputs have determined the technological level of coffee production.

Most of the farmers use family labour as the main labour force. There is a predominance of male labour in maintaining the plantations, with female and child labour being used solely during the crop harvest.

b) Cattle raising in Pedra Roxa is a secondary activity, with most of the farmers having a small number of cattle for beef and dairy production. As in Santa Marta cattle raising is a form of capital investment, with only one rural producer rearing dairy cattle as an economic activity.

The traditional system to rear the cattle uses fire to clean and increase the area of pasture. The native vegetation is burnt to plant *Paspalum spp* or *Brachiaria spp* on the farms. The only external inputs are vaccines.

Almost all the rural producers in Pedra Roxa cultivate subsistence crops such as rice, beans and corn in between coffee crops. The beans are used for human

consumption, and corn and manioc are used for both human consumption and livestock feeding. In addition, some farmers produce fruit and horticultural produce that is sold in the neighbouring municipality of Iuna. The main products are oranges, bananas and vegetables, which have a market demand in the neighbourhood. Difficulties arise due to transport costs, production costs because of the expense of herbicides, pesticides and specific fertilisers, the lack of labour resulting from the rural exodus, coupled with the lack of programmes for rural extension. Consequently this activity is less important in the region, despite the good ecological conditions.

Some farmers also supplement the family income with vegetable extractivism. A variety of plants are extracted including *palmito* (*Euterpe edulis)* which is especially appreciated in the local cuisine, although its collection is not permitted by IBAMA. These palmitos are sold in Ibitirama, Iuna and Alegre. In addition, bamboo (*Bambusa sp*) is utilised mainly as a raw material for sieves and baskets used in the coffee harvest.

4.6. Socio-economic characterisation of Rural producers in Pedra Roxa Village

Using the 8 variables described in the previous chapter, interviewees were classified into 4 categories. The main objective is to describe each category using the indicators outlined earlier. These comprise the size of area, annual Gross Value of Agricultural Production, Gross Value of Commercialised Production, the type of labour, other economic activities, the level of schooling, use of external industrialised inputs and use of machinery.

4.6.1 Peasants

There are two rural producers categorised as peasants in this category. They have farms smaller than 50 hectares, situated in the mountains of Caparaó. The main crop is coffee as well as subsistence crops such as corn, beans and rice. There is limited area available for production farming and, in addition, they are not allowed to increase the areas of crop production as a result of protection for the region covered by Atlantic rain forest in and adjacent to the neighbouring National Park of Caparaó.

Smallholders in this category have a Gross Value of Agricultural Production of less than U$ 1000 and they sell less than 50% of their agricultural production. Surplus produce (to domestic requirement) is used to exchange for goods with relatives and neighbours.

The only labour force used by these farmers is family labour. The farmers and their families often work as share croppers or salaried workers for other farmers during the coffee harvest or in the clearing of pastures. One rural producer has no schooling and the other has reached primary education level.

The only inputs utilised by these farmers are small amounts of fertiliser for coffee crops. They do not operate machinery on their properties, using simple home made tools.

Table 4.2. Socio-economic categories of rural producers of Pedra Roxa, state of Espirito Santo. GVAP = Gross value of agricultural production; GVCP = Gross value of commercialised production; TFL = Total family labour; TLP = Total labour of the property.

Variables	Socio-economic categories									
	A (N=2)		B (N=4)		C (N=5)		D (N=3)		Total (N=14)	
	n	N/n (%)	n	N/n (%)	n	N/n (%)	N	N/n (%)	n	N/n (%)
Property area (ha)										
< 50	2	100	3	75	4	80	-	-	9	64.3
50 — 100	-	-	-	-	1	20	2	66.6	3	21.4
100 — 500	-	-	1	25	-	-	1	33.3	2	14.3
500 — 1 000	-	-	-	-	-	-	-	-	-	-
1000 —5000	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-
GVAP - US$										
< 1000	2	100	-	-	-	-	-	-	2	14.3
1000 — 6000	-	-	4	100	-	-	-	-	4	28.6
6000 — 18000	-	-	-	-	5	100	-	-	5	35.7
> 18000	-	-	-	-	-	-	3	100	3	21.4
GVCP/GVAP										
< 50 %	2	100	-	-	1	20	-	-	3	21.4
50 — 60%	-	-	1	25	-	-	-	-	1	7.2
60 — 80%	-	-	-	-	1	20	-	-	1	7.2
> 80%	-	-	3	75	3	60	3	100	9	64.3
TFL/TLP										
< 40%	-	-	1	25	4	80	1	33.3	6	42.9
40 — 55	-	-	-	-	-	-	-	-	-	
55 — 70		-	-	-	-	-	-	-	-	
> 70	2	100	3	75	1	20	2	66.6	8	57.1
Other activities										
yes	2	100	1	25	3	60	2	66.6	8	57.1
No	-	-	3	75	2	40	1	33.3	6	42.9
Education level										
No Schooling	1	50	1	25	-	-	-	-	2	14.3
Primary	1	50	3	75	5	100	2	66.6	11	78.6
Secondary	-	-	-	-	-	-	1	33.3	1	5.6
University	-	-	-	-	-	-	-	-	-	
Inputs										
Fertilisers	1	50	4	100	5	100	3	100	13	92.9
Selected seeds	-	-	-	-	5	100	3	100	8	57.1
Pesticides	-	-	2	50	3	60	1	33.3	6	42.9
Vaccines	-	-	-	-	-	-	1	33.3	1	7.1
Animal feed	-	-	-	-	-	-	-	-	-	
Seedling			2	50	3	60	1	33.3	6	42.9
Machinery										
Possess	-	-	-	-	1	20	1	33.3	2	14.3
Rents	-	-	1	25	1	20	-	-	2	14.3
Does not use	2	100	3	75	3	60	2	66.6	10	71.4

Based in field survey 1995

4.6.2. Family Farmers

There are four rural producers characterised as family farmers in this group. Three of these rural producers have farms smaller than 50 hectares and one has a farm over 100 hectares in size.

The Gross Value of Agricultural Production (GVPA) varies between 1000 and 6000 U$ (Table 4.2). The main crop produced is coffee followed by subsistence crops such as corn, beans and livestock, with most of the production destined for market. Three farmers sell more than 80% of production and one sells 60% of production. Most of farmers do not have any other economic activity. The properties depend upon family labour, although one farmer uses share-cropping as the main source of labour. One rural producer has no schooling and the others have primary level of education.

Large amounts of agricultural inputs are consumed, such as fertilisers, herbicides and coffee seedling. Machinery is not appropriate in the area because the underlying geology (gneiss) generates steep and rugged relief and because of the cost of purchase or rent. Despite this one farmer continues to use machinery.

4.6.3 Rural producers with medium level of income

This category is composed of 5 farmers with a medium level of income. Four of these rural producers have properties smaller than 50 hectares, although one of them owns a small area and rents land from others, whilst the other rural producer has a property between 50 and 100 hectares (Table 4.2). Most of them produce

coffee as the main crop, although one farmer also produces fruit, vegetables, and manufactures sieves and straw baskets for sale in the region. In addition, one farmer raises cattle.

The GVPA of farmers in this category varies between U$6000 and 18000 (Table 4.2). The production of these farmers is predominantly for market with the exception of one producer who sells less than 50% of production. The commercial activities of the others exceed 60% of their farm output.

There is a predominance of family labour in this category, although other forms of labour are utilised such as exchanging days of work or share cropping. In addition one farmer carries out maintenance work for the other farmers, and in return they work on his farm. Usually, one day building work is repaid by four days farm work.

There is a large consumption of external inputs such as fertilisers, selected seedlings and vaccines, although only one farmer uses machinery to work his land. The remaining farmers do not use any form of mechanisation.

4. 6.4. Rural producers with high level of income

This category is composed of 3 rural producers with high levels of income. Two rural producers have properties with areas between 50 and 100 hectares and one has a property with an area of around 150 hectares. All farmers in this category produce coffee as a main crop and grow subsistence crops. One rural producer also raises cattle as a source of income and investment. Two rural producers conduct

other economic activities, for example one has a supermarket in Santa Marta and another has a clothes factory. All the rural producers in this category have a GVPA above U$18000 and sell over 80% of their production (Table 4.2).

The farmers in this category use different forms of labour on their properties. One uses family labour, another contracts workers for all activities, and the third uses share croppers to help with farm activities. Two have a primary school education and one has secondary education.

There is a large consumption of external inputs in these farms. They use fertilisers, selected seeds, vaccines and seedlings. In contrast to the others one rural producer, worried about the environment, avoids pesticides and uses dung as fertiliser for the coffee and subsistence crops. Only one farmer uses machinery on his property.

4.7 Pedra Roxa and National Park of Caparaó

Pedra Roxa is a small settlement located in the North of Santa Marta and Ibitirama. Most of the farmers live on their properties because Pedra Roxa has few facilities except a primary school, a bar and a Catholic and Methodist church.

The majority of small farms have property in the high lands of Pedra Roxa, close to the borders of the National Park of Caparaó. The small farmers plant coffee, rear cattle and plant subsistence crops as the main source of incomes. The problems of land tenure, the enlargement of coffee plantations, the clearance of pastures, the extraction of palm tree heart, bird poaching and quarrying are the main sources of conflicts between farmers and IBAMA in Pedra Roxa.

As in Santa Marta, the small farms in Pedra Roxa enlarged the areas of coffee planted in response to the high price of coffee in the market. The small size of the properties led the farmers to deforest the areas neighbouring the National Park to enlarge the coffee plantations.

The extraction of bamboo (*Bambusa sp)* and palm tree (*Euterpe edulis)* are traditional activities in the region, but generate many conflicts between farms and IBAMA. The bamboo is used as a raw material to produce sieves and baskets, essential in the coffee harvest. The palm tree is a traditional food at Easter for the Catholic population.

The rural exodus in the region has meant that farm labour is expensive for small farmers in Pedra Roxa. As a result they use fire, the most inexpensive tool, to clean the pastures especially in the regions of accidental relief. Frequently, the fire encroaches upon the natural resources of the National Park, causing increased conflicts between the farmers and the national Park.

Bird poaching is a common activity in Pedra Roxa. The birds are often poached in the forests neighbouring the National Parks, or sold to other farmers and the municipalities of the region. If they are found IBAMA confiscates the cages containing the birds and fine can be imposed to deter further poaching in the region.

South of Espirito Santo quarrying is an important economic activity. In 1995, IBAMA closed down a gneiss quarry located close to the borders of the National Parks of Caparaó and fined the owner. Since then there has been no quarrying in the vicinity of Pedra Roxa.

4.8. Alto Caparaó

In this section the main socio-economic characteristics of the village of Alto Caparaó will be examined.

Alto Caparaó is located in the municipality of Caparaó in the state of Minas Gerais, bordering Caparaó National Park and close to its main entrance. The main economic activities in Alto Caparaó are semi-intensive coffee production, cattle raising, subsistence crops and ecotourism.

In the last century, the Caparaó region of Minas Gerais was covered by Atlantic Rain Forest, but with the expansion of coffee from Rio de Janeiro it was soon cleared. The occupation of land intensified with the arrival of immigrants especially those from Germany, Italy and Switzerland, with the creation of large farms employing salaried workers.

At present the area is divided between coffee crops and dairy cattle, although smallholders, stimulated by the current price of coffee, have invested all their economic resources in coffee plantations. The rural entrepreneurs having higher income levels, have invested heavily in coffee production. Coffee is produced to a very high quality, and some have exclusive contracts to export all they produce.

The production of subsistence crops is solely for human and livestock consumption. The subsistence crops produced are principally corn, beans, rice, corn manioc and vegetables and are sold in the region.

The relief, the landscape and the presence of waterfalls in the National Park of Caparaó have contributed to the attraction of a large number of tourists to the region every year. Tourism has developed into an important source of income for the

region. According to Bomtempo (1994), between 1987 and 1989, 11951 tourists visited the region whilst in 1991 there were 17344 visitors, increasing the visitor level to the park by 56% (Bomtempo 1994). All ecotourism in the Caparaó National Park passes through Alto Caparaó, as it is the only point of access to the Park authorised by IBAMA.

4.9. Socio-economic characterisation in Alto Caparó Village

Using the 8 variables described in the previous chapter, interviewees were classified in 4 categories. The main objective is to describe the general characteristics of each category in terms of size of area, annual GVAP, GVCP, type of labour, other economic activities, schooling level, use of industrialised inputs and use of machinery.

4.9.1. Peasants

There is one farmer categorised as a peasant in Alto Caparaó. His land was used in the creation of the National Park, and his only means of cultivation is a small garden. This farmer produces at a subsistence level with a low Gross Value of Agricultural Production and a low level of external sales. The farmer has other sources of income and has reached primary school education level. There are no inputs consumed and the severe nature of the physical relief does not permit the use of machinery.

Table 4.3. Socio-economic categories of rural producers of Alto Caparaó in the state of Minas Gerais GVAP=Gross Value of commercialised prodution;TFL= Total familiar labour; TLP=Total labour of the property.

Variables	Socio-economic categories									
	A (N=)1		B (N=)		C (N=)3		D (N=)9		Total (N=)	
	n	N/n (%)	n	N/n (%)	n	N/n (%)	N	N/n (%)	n	N/n (%)
Property area (ha)										
<50		100	-	-	3	100	-	-	4	30.8
50 — 100	-	-	-	-	-	-	1	11.1	1	7.6
100 — 500	-	-	-	-	-	-	1	11.1	1	7.6
500 — 1 000	-	-	-	-	-	-	5	55.5	5	38.5
1000 —5000	-	-	-	-	-	-	2	22.2	2	15.4
> 5000	-	-	-	-	-	-	-	-	-	
GVAP - US$										
< 1000	1	100	-	-	-	-	-	-	1	7.6
1000 — 6000	-	-	-	-	-	-	-	-	-	
6000 — 18000	-	-	-	-	3	100	-	-	3	23.1
> 18000	-	-	-	-	-	-	9	100	9	69.2
GVCP/GVAP										
< 50 %	1	100	-	-	-	-	-	-	1	7.6
50 — 60%	-	-	-	-	-	-	-	-	-	
60 — 80%	-	-	-	-	1	33.3	-	-	1	7.6
> 80%	-	-	-	-	2	66.6	9	100	11	84.6
TFL/TLP										
< 40%	1	100	-	-	2	66.6	4	44.4	5	38.5
40 — 55	-	-	-	-	-	-	4	44.4	4	30.8
55 — 70	-	-	-	-	-	-	-	-	-	
> 70	-	-	-	-	1	33.3	1	11.1	1	7.6
Other activities										
yes	1	100	-	-	2	66.6	3	33.3	6	46.2
No	-	-	-	-	1	33.3	6	66.6	7	53.8
Education level										
Illiterate	-	-	-	-	-	-	1	11.1	1	7.6
Primary	1	100	-	-	3	100	5	55.5	9	69.2
Secondary	-	-	-	-	-	-	1	22.2	1	7.6
University	-	-	-	-	-	-	2	22.2	2	15.4
Inputs										
Fertilisers	-	-	-	-	3	100	9	100	12	92.3
Selected seeds	-	-	-	-	-	-	3	33.3	3	23.3
Pesticides	-	-	-	-	2	66.6	3	33.3	5	38.5
Vaccines	-	-	-	-	1	33.3	6	66.6	7	53.8
Animal feed	-	-	-	-	1	33.3	1	33.3	2	15.4
Seedling	-	-	-	-	1	33.3	1	11.1	2	15.4
Machinery										
Possesses	-	-	-	-	-	-	2	22.2	2	15.4
Rents	-	-	-	-	-	-	3	33.3	3	23.1
does not use	1	100	-	-	3	100	4	44.4	8	61.5

Based in field survey 1994-1995

4.4.2. Rural Producers with medium level of income

There are three rural producers characterised as having a medium level of income, with farms smaller than 50 hectares. The main cultivated crop is coffee followed by corn and beans. One farmer has his own dairy herd. This group of producers have a Gross Value of Agricultural Production between U$6000 and 18000.

One farmer sells between 60 and 80% of production. He is the owner of a hotel bordering the National Park of Caparaó, and produces food and goods to be consumed in the hotel. The other farmers sell over 80% of production.

One property depends on contracted labour and the others utilise contracted workers. All of these rural producers have a primary level of education.

The three farmers use large levels of inputs in the production of coffee. The most commonly used are fertilisers, followed by herbicides, insecticides, vaccines, animal feed and coffee seedlings. The physical relief does not allow the use of machinery.

4.9.3 Rural Producers with high level of income

There are 9 farmers categorised as rural producers with a high level of income in Alto Caparaó. The main source of income is coffee, followed by dairy cattle and subsistence crops. They have GVAP above U$18000 and all production is geared to toward the market demand (Table4.3).

One farmer only uses family labour, whereas the other farmers use secondary labour sources on their farms. Permanent workers are contracted to carry out

activities linked to the rearing and milking of dairy cattle, with temporary workers assisting in coffee production and the cleaning of pastures. Thirty three per cent of these farmers have other economic activities.

There is a large consumption of external inputs by farmers in this category, such as fertilisers, selected seeds, vaccines, pesticides, herbicides and insecticides. Only two of the farmers use machinery on their properties.

4.10 The National Park and Alto Caparaó

Alto Caparaó is the most developed village around the National Park of Caparaó. The village is located close to the only entrance to the National Park and as a result there are large hotels, restaurants, logging areas, primary school, shops, bars, several Protestant churches of different denominations and an asphalt road linking the Park to the municipality of Caparaó.

The majority of farmers in Alto Caparaó have large farms and plant coffee as part of an intensive agricultural system, and with a large consumption of industrialised inputs. In some areas of Alto Caparaó, centennial coffee plantations can be observed and these are still producing due to the large consumption of inputs. The improved economic conditions of rural producers in Alto Caparaó have allowed them to maintain the coffee plantations with high levels of fertiliser, even in years when the market price for coffee is low.

Despite their better economic conditions, some of the producers still use fire to clean and renew the native pastures. The relief and the climate conditions aid the spread of the fire, which if it is large enough can encroach on the borders of the

National Park. This has become a point of conflict between the farmers and IBAMA.

The high price of coffee led to some farmers enlarging the area of coffee production. This has led to some of the remaining areas of Atlantic forest being deforested to plant coffee. Even so land tenure is less intense in Alto Caparaó and most of the that farmers have been expropriated received economic compensation. The close proximity of the farms to the improved road system has meant that Alto Caparaó has more studies than other regions close to the Park.

The local population of Alto Caparaó is less dependent on the use of natural resources found in the Park, than in Santa Marta and Pedra Roxa. However, the intense use of the native vegetation to rear animals and produce coffee, in the areas adjacent to the National Park before its establishment, has meant the native vegetation is less exuberant than that found on the Espirito Santo side.

The next chapter will analyse the socio-economic impact, caused by the establishment of the National Park of Caparaó, on the villages of Santa Marta, Pedra Roxa and Alto Caparaó.

CHAPTER 5

The social impact of the creation of the National Park of Caparaó

The socio-economic characterisation of the farming communities examined in the previous chapter identified the level of heterogeneity between the different categories of rural producers around the National Park of Caparaó, and highlighted significant factors affecting these rural producers. This chapter analyses the socio-economic impact of the creation of the Park on the villages of Santa Marta, Pedra Roxa and Alto Caparaó. The important components of this analysis include, land tenure, fire, environmental perceptions, tourism and benefits.

5.1 The creation of National Park of Caparaó

The word Caparaó originates from the indigenous language and means water that falls from mountains. The mountains range divides Minas Gerais and Espirito Santo states. The area was originally occupied by indigenous Puris and had been colonised relatively late (in the last century) by Europeans, particularly the Italians, Germans and Swiss. Since the last century, visitors have been coming to the region of Caparaó to hunt, for military exercises, or simply to view the spectacular landscapes (IBAMA, 1994).

In 1859 Emperor Pedro II ordered a flag to be erected on Pico da Bandeira (Peak of the Flag), located within the National Park area, and this was believed until 1964, to be the highest point in Brazil. In order to protect the area the Reserva Estadual do Pico da Bandeira (State Reserve of Pico da Bandeira) was created by state decree number 123 on the 14th of June of 1948. To aid them in protecting the area the population of Alto Jequitiba started to organise themselves and requested the creation of a National Park. The municipality of Espera Feliz asking for the creation of a National Park of Alto Caparaó followed this, but both were refused due to a lack of funding. After successive requests for the creation of a National Park, Caparaó was formed by Federal decree 50 646 on the 24th of May 1961. In addition, on the 18th of November 1961, the 4836 ha of the Reserva Estadual do Pico da Bandeira were donated by Minas Gerais State to the Federal Government for inclusion in the National Park of Caparaó (IBAMA, 1994)

Before the creation of the National Park the lands of Caparaó were used to farm animals, and most farmers who had land expropriated, continued to keep cattle and other livestock in the Park. The farmers were allowed to "clean"(clear land for) pastures without the interference from Conservation Agencies (IBDF, as it was, now IBAMA). The farmers grazed goats, horses and cattle and cultivated coffee on their lands.

According to IBAMA (1994) a topographic survey did not began until after the establishment of the National Park because the Decree that created the National Park did not establish limits or a land registry. Initially the land comprised 16000 ha, which was calculated during the first survey about the Park. The 16000 ha are located in the highlands (above 1300 metres), and were selected to initiate the

process for purchasing the lands registered with a low environmental impact. Up to 1994, IBAMA had purchased 9341 ha from properties located in the neighbouring areas of Pico da Bandeira, Pico do Cristal and Pico do Camilo and this land made up 35% of the area proposed for the National Park. At present, there is little purchase of land to allow the formation of a clearly defined boundary to complete the basic survey, and additionally to restart the payment of compensation for the land.

The current position of the Park is therefore unstable, causing alienation between some sections of the community. The next sections will analyse the main elements of the social and economic impact of Park formation in the villages of Alto Caparaó, Santa Marta and Pedra Roxa.

5.2 Land tenure

The most significant element of the social impact caused by the creation of the Park of Caparaó is land tenure. The National Park brought many disturbances to the system of land property in the region, as the production system was established for cattle raising and coffee production, without any consideration of nature conservation.

There are many different forms of land tenure around the National Park of Caparaó. Firstly, the land at Alto Caparaó is considered "grab land" (*terras griladas)* in other words illegal occupancy. The land of Alto Caparaó had been colonised during the last century and the high lands were used as communal areas for cattle raising and the low lands as large coffee farms. The majority of the communal lands were never legally registered and most of the community had access to these lands,

which were used for grazing. The situation altered twenty years ago, when an individual arrived in the community with titles for the lands dating from the last century. The judge of the Municipality of Leopoldina concluded that the documents were valid, meaning that the majority of land within the vicinity belonged to this individual, thus nullifying other claims. The incumbent farmers were considered squatters, and since then all land transactions in Alto Caparaó have been without valid documentation. At present, many of the farmers of Alto Caparaó are still claiming definitive land rights.

As was observed in chapter one, land tenure problems are common in different regions in Brazil and many times *de jury* land possession does not concur with *de facto* land possession. Based on this reality the producers of Alto Caparaó incorporated the ground they possessed into their farms. Moreover, many land transactions are made in Alto Caparaó in order to expand coffee plantations without concern with the legal status of appropriated land. Some of the interviews illustrate this situation in Alto Caparaó: -

> *"An old man appeared here, saying he was the owner of Alto Caparaó and he cancelled everybody's documents. Here we buy and sell land without documents but nobody registers. Nobody is scared of losing his or her land"* (Rural Producer with a high level of income in Alto Caparaó).

The National Park is also involved in this problem of land grabbers, since the farmers sold their land to IBAMA without valid titles. This affects the majority of the land purchased by IBAMA. The grab land in the National Park has being analysed in the Federal Court in action to legalise this situation. However, there are rural producers complaining that they have had legalised land occupied by the National Park for which they did not receive any economic compensation. Thus, the situation

of land possession is chaotic in Alto Caparaó, because there are a mosaic of land with valid and invalid titles around and inside the Park area. Moreover there is land without valid title that has had compensation and land with valid titles that has not received compensation. This situation is illustrated by the following quotation: -

"The 18 properties that the National Park purchased in Alto Caparaó, all titles were cancelled. Today the National Park does not have one title, nevertheless nobody in Alto Caparaó has. My lands are legitimate if they have purchased my lands but they do not pay, they are not included in the grab area of Alto Caparaó because it is considered 3 Barras. It is a situation that is pending" (Rural producer with a high level of income in Alto Caparaó).

Another type of land tenure directly involves the National Park and rural producers. This form of land tenure is created when some rural producers do not have valid documents for the possession of the land. These rural producers have to leave their cultivated lands when IBAMA requisitions them to increase the protected area of the Park, and without the provision of compensation. Frequently, the rural producers involved in this type of land tenure are small farmers of the traditional communities around the National Park of Caparaó, such as squatters and share croppers. IBAMA just compensates land that has titles and some of these farmers do not have squatter's rights.

A further problem of land tenure arose when IBAMA decided that some areas that were important for the protection of ecosystems such as sources of rivers, gallery forests, areas above 1300 meters and areas neighbouring the National Park. As a result, IBAMA forbids any activity in these areas, such as deforestation, to enlarge pastures or plantations, the burning of pastures, cattle ranching, vegetation extractions, quarrying and other land uses. However, the rural producers who have valid titles continue to pay tax for these lands without any economic compensation.

This situation can be observed most often in Santa Marta and Pedra Roxa. These areas are carefully watched by IBAMA, and usually the farmers are fined for the use of important natural resources or the use of fire on their properties.

"Here in our region at the source of the Pedra Roxa River, nobody receives benefits. The seven farms pay very expensive taxes for that land and I complained about it. They have to solve this situation."(Peasant in Pedra Roxa)

The land tenure created by the Park expansion in areas of significance for conservation increased the social problems between National Park and their neighbouring communities A simmering tension can be observed between producers not economically compensated and IBAMA. These farmers believe that IBAMA erroneously disturbed their land without offering any type of alternative to provide subsistence. Moreover, the majority of them belong to categories with a low level of income such as peasants or family farmers. After the expansion of the Park some farmers were forced to abandon areas of land and remain with only small parcels adjacent to their houses. Thus this small production is not enough to provide even subsistence levels, requiring producers to work as salaried employers for other rural producers in the region, or by retirement pensions. The high price of coffee and the expansion of new crops in the region make these farmers very anxious for a solution to these land tenure problems. Payment for the land not compensated could be a solution, because the farmers could buy land in other areas of the municipality and return to independent production.

"... We have a small farm in the highlands that the National Park took over and for which they pay nothing. We just pay tax but can take nothing from there, and cannot use a hand hoe. We can not even take a palm tree heart..."
(Peasant from Pedra Roxa)

"They came here and they prohibited me from clearing the lands, yet if we proposed to sell they will not say that they will buy. They say that the government does not pay. I started to clean the pastures here and they say that I cannot do so. To touch this tree here I have to obtain a licence and also to plant maize and beans. I just have this small square of land to plant. The production of coffee is also very small. "(Family farmer from Santa Marta)

It is traditional in Brazil to register land at a very low value to avoid paying tax, especially areas not suitable for crops and without improvements and covered by forest, sources of rivers and mountains. Many of the farms in Caparaó are located on land, which has irregular relief, is rocky and covered by forests; hence it is agriculturally unproductive. Despite this the farmers are still obliged to pay tax. Thus these farmers register their land with a very low value to pay the minimum tax possible.

Thus, when the farmers are divested from the land they are compensated at values based on the tax payment and value of the land. The compensation is at a value many times below the market price despite the great ecological importance of these areas. Consequently, the farmers are unable to purchase new lands of the same size in the lowlands of the municipality. This situation is described through the following quotations: -

"Look they paid me a trifle for 24 hectares in the highlands of Pedra Roxa. I stayed to collect wood from the ground. They gave me just 30 days. There is much cedar wood on the ground. I sold the land for US 6300,00, which was cheap. It was not sufficient to buy 9 ha in the lowlands. They pay quickly, within 2 months they paid me. I went to Vitoria taking a photocopy of the documents after which I went to Belo Horizonte to receive payment"(Rural Producer with medium level of income of Pedra Roxa)

"*The lands were expropriated at the value in the land registry and nobody registered land at the real value of the property. They just compensated 20% of the rural producers, 80% did not receive any compensation. There was no negotiation; IBAMA give the price of land. The price is that. Finish"*(Rural Producer with medium level of income of Santa Marta).

After the creation of the Park IBAMA purchased some rural properties. At the moment IBAMA has stopped the purchase of new areas and is waiting for a definition of boundaries. However, there are some rural producers awaiting compensation for the land. Some of these farmers do not posses other areas, which they could cultivate. Therefore some farmers became salaried workers and some of them migrated to the cities.

"The majority that receive economic compensation received it 8 years ago. Since then nobody has received anything more and some of them have died or moved to other regions because they became upset at having to sell their land against their wishes. It is necessary that the government pay compensation for those who used to have land which is now inside of the National Park of Caparaó and cannot cultivate it" (Rural Producer with medium level income of Santa Marta)

The problem of lack of economic compensation for areas in Santa Marta and Pedra Roxa affects much of the municipality of Ibitirama because the farmers try to involve the politicians in search of a solution for this problem that affects the whole region.

*This is a serious problem for the President of the Republic, because many rural producers have not been compensated for the land. The expropriation and compensation for the land should be set at a just value. For many of them the land is all they have. They can not leave the lands without the appropriate conditions or be transferred to another place without resources. (*Mayor of Ibitirama*).*

The above thus provides a picture of land tenure in the vicinity of the National Park of Caparaó. The problems arising from land tenure involving IBAMA and the rural communities creates a difficult relationship between rural producers and the National Park. For the majority of rural producers the land tenure issue has brought many economic difficulties, most especially for small-scale farmers whose

Plate 5.1 Coffee crops around National Park of Caparaó

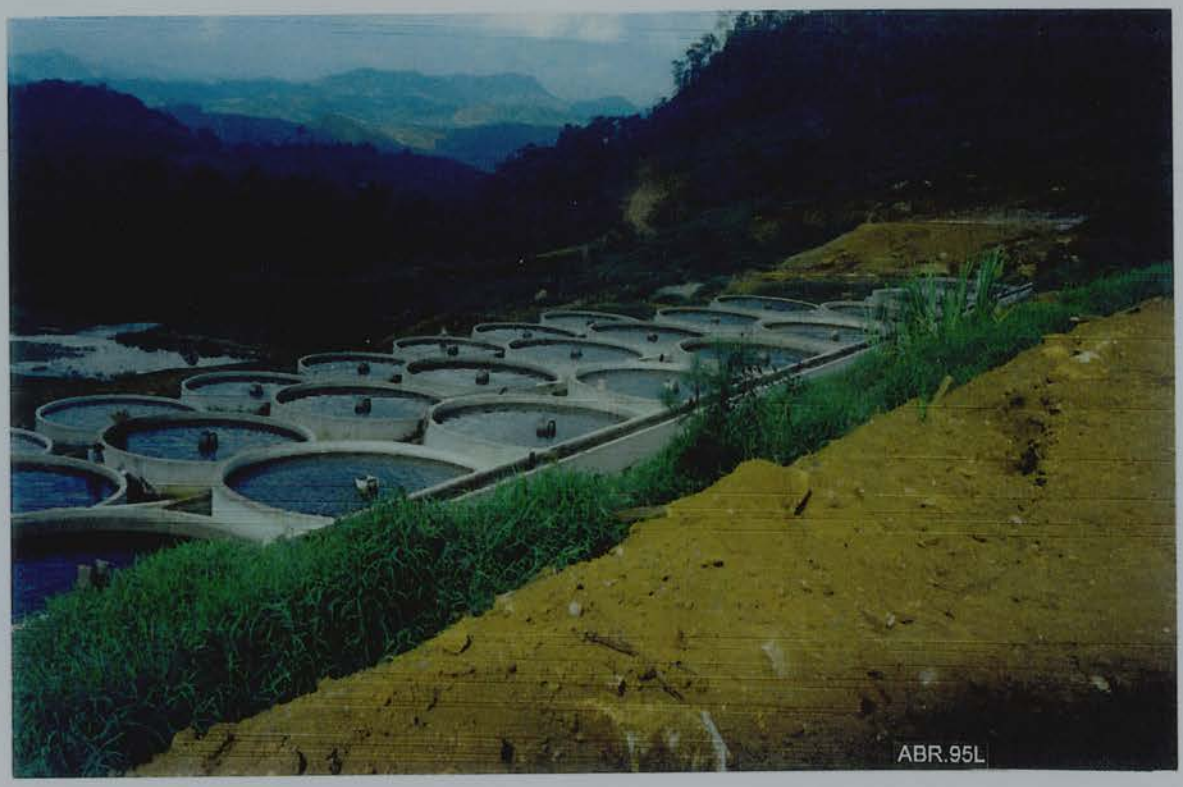

Plate 5.2 Fish Farming around National Park of Caparaó

Plate 5.3 Pedra Roxa Village and the National Park of Caparaó

Plate 5.4 Pastures around National Park of Caparaó

lands have been occupied by the Park rendering production impossible. The lack of adequate compensation for the lands expropriated by the creation of the Park has therefore created a hostile view of the National Park, by the rural producers.

In addition, problems for the management of the National Park of Caparaó classified by IBAMA such as invasion, cultivation, grazing, and extraction of plants are normal land uses for some of the rural producers. The majority of the rural producers are peasants, squatters or family farmers who do not have other land for subsistence production and did not receive any economic compensation or benefits for the land, which they have traditionally occupied.

5.3 Use of Fire

A significant element in this analysis is the use of fire in the farming calendar. According to the respondents there are two types of fires occurring in the region, the open burning for clearances and secondly arson.

The high price of coffee has led many rural producers of different categories to increase the area of coffee plantations in Alto Caparaó, Santa Marta and Pedra Roxa. The farms in Alto Caparaó, particularly those with medium and high levels of income are deforesting the last areas of Atlantic rain forest to plant coffee encouraged by the market prices. In the villages of Santa Marta and Pedra Roxa, the rural producers expand and fertilise areas of coffee plantations when there are high market prices.

Usually the producers light the fires toward the end of the winter (August / September) when the vegetation is dry. They then clean the area manually, since the

topography does not permit the use of machinery, and they wait for the rainy season to plant coffee and subsistence crops manually again. Sometimes the fires are lit in areas neighbouring the National Park, and if discovered by IBAMA the farmers are heavily fined.

The topography of the region has meant that the ancient practice of burning to open new areas of pastures is very common. During the months of August and September the farmers burn the native vegetation and wait until November with the onset of the rainy season to plant pastures or regrow natural pastures. The relief and the dry vegetation facilitate the rapid spread of the fires and it often reaches the boundaries of the National Park. The cost of alternative practises, particularly to reduce weeds, makes burning the only tool readily available to small-scale farmers. However, they also know the negative effects of burning the vegetation, which can be observed in the local opinions: -

"I try to avoid burning my land because burning damages the things that we want and as well as the things that we do not want. It can also spread to the neighbours."(Family producer from Santa Marta*)*

For some rural producers with medium and high levels of income, fire is an enemy on their properties. In these farms the use of fire under any circumstance is prohibited. This can be observed in their comments:

*"I am against burning with fire I also have a small forest and if they burn I fight against it..."(*Rural Producer with medium level of income from Pedra Roxa)

*"This year we inserted a clause in the contract that we have with the sharecroppers that burning is prohibited, but we are not there 24 hours per day 365 days per year."(*Rural producer with high level of incomes in Pedra Roxa)

A service of technical extension linked to the Park with specific programmes of development for small-scale producers in order to substitute the use of fire and preserve the forests farmers could be a solution for the farmers in Caparaó. Here one farmer is speaking about how IBAMA should behave in relation to small holders who uses the fire as a means of production: -

IBAMA should have incentives for people to plant seedlings that the government has. But instead they pursue the peasants who burn less than 1 ha of weeds. They do not give instructions on how to plant or how to preserve forests .Now they became upset if we burn weeds .So the small farmers became afraid and they became impoverished and starving to prohibit the burning of the forests, but small farmers are afraid to talk to them (IBAMA representatives). They are armed. They have to visit the small farmers and to talk to them explaining what to do. Giving assistance to them. It is something that IBAMA should do"

(Rural Producer with medium level of income of Pedra Roxa)

A second category of burning occurring in the region is in the form of arson against IBAMA. Some of the rural producers who were not compensated when their lands were expropriated became tired of waiting for economic compensation and have consequently lit malicious fires in the areas bordering the National Parks. If there is proof of arson the rural producers are fined by IBAMA increasing the social tension in the neighbouring areas around the Park. A farmer and politician of Santa Marta illustrates this:-

"Most fires are generated by people whose lands have been expropriated and they are disgusted because they have not received compensation"(Rural producer with medium level of income in Santa Marta and Vice Mayor Ibitairama)

Another type of arson that can be observed stems from the revenge against fines, deforestation, fire, grazing, plantation, extractions and quarrying. This type of arson provides evidence of the difficult relationship between rural producers and

IBAMA in the Caparaó region. The fines that IBAMA representatives give as punishment to the rural producers for damaging the ecosystem exacerbate the negative perceptions that the rural communities have about the National Park, and act to increase the damage to ecosystems and the aversion to the Park. It can be observed in the following comment:-

"My *boys burnt a bunch of weeds in the pastures and IBAMA fined me, nobody cares more for my forests than I do. I bring seeds from afar to spread here and they fined me because I burnt a bunch of weeds."*(Rural producer with high level of incomes from Alto Caparaó)

The majority of fires that afflict the region are caused by retaliation against fines utilised by IBAMA, who consider them to be the only way of punishing human activities in the neighbouring areas of the Park. The high value of fines and the difficulties of farmers with low level of income evidence the retaliatory character of these fires:-

"In our region you see fires on all sides all for revenge against IBAMA because they disturb everybody. They fine us for nothing. Nobody understands our property better than us. They have became involved with everything. The Park became a bonfire when you look from Minas Gerais"... Rural producer with high level of income from Alto Caparaó)

"The fine that they impose does not solve the problem because they fine on the value of land. The small-scale farmer say to them - stay with the land. So they burn their neighbour in revenge. In this area neighbouring lands are burnt every year. The IBAMA authorities do not know who starts the fires and everything stays the same".
(Trout Farmer)

The above descriptions provide evidence of the difficult situation in the villages of Alto Caparaó, Santa Marta and Pedra Roxa. The majority of fires are for pasture clearance or to increase the plantation areas, and could be avoided or

replaced for other agricultural practices in order to avoid disturbances to the ecosystems. The rural producers with high levels of income use techniques with low environmental impact, but high economic cost. Small-scale farmers, due to the high costs cannot use these techniques. The arson attacks that occur in the region are the result of land tenure problems and antipathy towards IBAMA. The situation could change with different strategies of management by the National Park and greater understanding of the difficulties encountered by local people.

5.4 Benefits

The benefits that the rural producers expected from the National Park are also evident in this analysis, with the majority of rural producers expecting to benefit in some way. The biggest benefit to the farmers of Santa Marta and Pedra Roxa would be better road connections to transport agricultural products. Rural producers of different categories and politicians from Ibitirama support this idea. The road conditions in these regions are very bad and in the rainy season it can be very difficult to transport goods and people. It is common for traffic to be interrupted due road conditions:-

"'I think that since they have the power in their hands, they could construct a road'(Rural producer with medium level of income).

*"...if they asphalt the road to Santa Marta it would be very good, we lack a good road to transport the production. When it rains in this area the road is washed away. (*Rural Producer with medium level of income from Santa Marta)

"This National Park does not brings anything to Ibitirama; I am suggesting an access road to the BR 262 passing between Santa Marta and Pedra Roxa. It will be bordering the Serra do Caparaó. I think that asphalt is necessary for tourism to grow in Ibitirama. (Mayor of Ibitirama).

Some rural producers with high levels of income and properties located in the areas neighbouring the Park consider the Park as a benefit. The environmental conditions of their farms are very good because the Park protects environmental components like water, forests and wildlife destruction by intruders:-

"Today we are the biggest watchers of the National Park. We are its biggest defenders. Any risk of water contamination and the first damage will be our problem because the trout need pure water. We know that the trout have to have over 5 PPM oxygen in the water if they are to breathe". (Trout farmer)

"I have an advantage in it (presence of the Park) because I like birds; the Park will help me keep my bees. If we keep bees we will take advantage of the Park, because our bees will go in to the forest. I do not see any disadvantage"(Rural producer with high level of income from Pedra Roxa)

"The National Park expropriated land which I had no means of cultivating because it was a forest and it was the source of water. I had no way of keeping an eye on it from my neighbours and intruders. IBAMA watch my property for me. I am neighbouring the river at the source. I was very lucky" (Rural producer with high level of incomes from Alto Caparaó)

Rural producers whose activities depend on the state of the environment, such as bee keeping or trout farming consider the National Park as an important benefit to the region, thus avoiding environmental alterations that could compromise their investments. The trout farmer in the region of Santa Marta is extremely concerned about any disturbance to the ecosystem that can cause an alteration to the water. For this reason the farm is carefully maintained and only those with prior permission are allowed onto the farm to prevent water contamination.

The small-scale farmers do not perceive any benefits arising from the National Park. In the view of these farmers, the park expropriated lands that they could use to expand their small pastures or plantations. These farmers also consider that the national park did not bring any development programme or road that could improve the region.

So in summary there is a split of opinions between those few inhabitants who have gained from the establishment of the Park and the majority who have received no benefits at all.

5.5 Tourism

The National Park of Caparaó is the most visited National Park in Minas Gerais. It has the most developed tourist infrastructure and receives many visitors from Minas Gerais, Espirito Santo and Rio de Janeiro.

Tourist activities are unequally distributed across the different villages around the National Park. Alto Caparaó is located at the entrance of the Park and is consequently more developed and has several activities linked to tourism. Some farmers have also become tourism entrepreneurs. The farmers with high levels of income have hotels and houses that they rent to tourists during the school holidays. The small- scale farmers rent horses and produce honey to sell in Alto Caparaó for the tourists and some wives make marmalade, sweets and handcrafts to be sold in the hotels and shops in the village.

These activities do not occur to the same extent in the other villages around the National Park. Some rural producers and politicians of Santa Marta and Pedra

Roxa believe that the tourism could be an important source of income contributing to the development of these areas.

"The benefits that the National Park brings is not for us but for the people of Brazil. When EMBRATUR or ECATUR came here to represent the interest of the State government, they did nothing and our Federal Government and Senators have no interest. When Dr Elcio Alvares was elected senator I wrote to him several times telling him that the National Park of Caparaó is neglected on the Espirito Santo side, and that the people are suffering pressure from the of IBAMA police from Minas Gerais. I asked him to create a road (BR 216) bordering the National Park and linking with the BR 262 Belo Horizonte-Vitoria. He answered that he was working to solve this situation and he did not forget our state."(Rural Producer with medium level of income of Santa Marta and ex politician of Alegre)

Tourism is not a major concern for most of farmers in Santa Marta and Pedra Roxa because only a few of then have economic conditions to diversify their activities into tourism. Moreover, there is not any program of development to encourage the transformation of agriculture into tourist activities to activities. However it is very important, in the politicians opinion because this activity can generate taxes and development for the towns around the National Park. Therefore, the politicians of the region have been doing all they can to increase the infrastructure of tourism in Caparaó, as can be observed in the following speech:-

"Ibitirama is included in the towns of Brazil with potential for tourism and it is not being developed . We have many things to show tourists such as sources of rivers, waterfall and beautiful landscapes. Few cities in Espirito Santo have the potential for tourists that Ibitirama has. I think that the future of Ibitirama is in tourism. The Park can bring people to live here, hotels, and logging areas can generate tax and I think that the town can profit. I shall meet the Senator Jose Ignacio, the Minister Dorothea and maybe even the President of the Republic (Mayor of Ibitirama).

Tourism is an important resource for local populations in many National Parks. In the National Park of Caparaó though it is just Alto Caparaó that benefits,

despite the National Park of Caparaó being located in a strategic region, relatively close to Vitoria, Belo Horizonte and Rio de Janeiro and having environmental conditions and scenic beauty that attract tourists from all over Brazil. Santa Marta has not benefited to the same extent. In Santa Marta they used to have a path to Pico da Bandeira that passed through a cave called Gruta de Sao Jorge. Today the path is located within the boundary of the trout farm. The trout farmer and IBAMA prohibited access to this path in order to avoid intruders in the area. Thus there is no longer access to Pico da Bandeira through Espirito Santo. The local population of Santa Marta and Pedra Roxa still have expectations about income, jobs and tax benefits as a result of tourist activities. These activities could become a substitute for environmental degradation and the Park could become an ally of small-scale farmers in their subsistence as Park guardians.

5.6 Environmental conservation

A further element in this analysis concerns perceptions about environmental conservation. Most of the farmers interviewed have environmental concerns but they have not received an effective programme of rural extension which focuses on environmental conservation.

During a period of three years from 1991 to 1994 the College of Federal University of Minas Gerais (Colegio Técnico da Universidade Federal de Minas Gerais) promoted a programme of environmental conservation linked to the National Park in the municipality of Caparaó, with the aim of training primary and secondary teachers of Caparaó. The principal objective of this program was environmental

education in schools in Alto Caparaó and other communities in the Minas Gerais side of the Park.

Another small program of forest extension funded by the American organisation the W.W.F (World Wildlife Fund) took place in the villages around the Park. This programme employed two forestry engineers with the aims of teaching techniques of forestry conservation to infringing rural producers. This program in reality tried to promote the conservation of natural resources through films, distribution of T-shirts, leaflets and talks at special community's events such as "tree" day, "world day of environment" and others. This project finished four years ago due lack of funding.

However, these programmes did not have much effect on the rural producers of Alto Caparaó, Santa Marta and Pedra Roxa because their aims and methods of approach were not focused on the socio-economic reality of the region. Therefore, the rural producers solve the environmental problems by themselves and follow management practices based on observation of nature and from their own experience. Issues concerning the use of pesticides, fire and erosion are always solved by themselves:-

"I used herbicides here at the beginning , but afterwards I think I spoiled the land. I do not know if I put too much herbicides and it spoiled and ruined the grass. Now the land is improving, I have planted many seeds ... it became better and now we have grass. I want to cut the grass with a scythe and when it grows I will use herbicide again just on the leaves so as not to damage the grass." (Peasant in Santa Marta)

Rural producers know the consequences of deforestation. They have particularly observed the relationship between deforestation and water conservation, due to the link with rainfall. They have compared the abundance of rainfall in the

past years and, they have made comparisons with lands that they know in the region. It can be observed in local opinions:-

*"Here before, we had 8 months of rain; today we have the opposite 8 months of sun shine. It is caused by deforestation"(*Family farmer and ex mayor of Ibitirama)

"Deforestation brings problems of rainfall here in Santa Marta. In the lowlands where there are more forests there is more rain"(Rural producer with medium level of income from Santa Marta)"

*"We have to preserve the forests because there is a lack of rain. The rainfall is going to reduce. The rain reduced. Before, there was a lot of rain here. To cross the Santa Marta River was very difficult, but today any child can cross. In 20 years the river has reduced 60% ."(*Rural Producer with medium level of income from Santa Marta)

Additionally, some rural producers are very concerned about land degradation and lack of forest in some areas of the region especially on the Minas Gerais side of Caparaó where more environmental disturbance can be observed than in Espírito Santo. Reforesting with native species are also considered important for the conservation of the region. Here two rural producers express their opinions about these topics:

"You travel from here to Minas Gerais:, you see so many ruined lands you do not know if it was coffee plantations or pasture. It is nothing . If we had forests today it would be much better. The difficulty that we have is to get wood and some people take advantage to finish everything" (Family farmer from Santa Marta)

*"We have an area of reforestation inside of the project, we are reforesting an area with around 800-1000 saplings of native species (*trout farmer*)*

The use of natural resources as raw material for local handicraft manufacture is essential for small-scale farmers of the region. The distance to markets and the

price of other raw materials make *Bambusa sp.* the most suitable raw material for baskets and sieves used in the coffee harvest. However, to collect *Bambusa sp.* it is necessary to have IBAMA authorisation. This is stressed in the speech of a farmer:-

"Nobody wants to deforest but, the place is full of weeds, the people from IBAMA want control of everything. To take a ***Bambusa*** *to make a basket it is necessary to talk with IBAMA"* (Family farmer from Pedra Roxa).

Another important issue for these rural producers is the preservation of fauna. In spite of this, there is some subsistence hunting due to the poor conditions of some peasants that need to complement their family diets with wildlife proteins. A technician from EMATER:- stresses this

*"Hunting is not hunting for sport. It is a hunting for subsistence. It is not killing an animal for pleasure. It is to bring the animal home to eat. "(*Technician from EMATER)

The old farmers of Caparaó who have lived through the alterations in the local landscape due to the advance of agricultural production are very concerned about the preservation of natural heritage for future generations. These farmers think that IBAMA is preserving their local fauna and flora for the future generations of Brazil:-

"The grand child need to know what is virgin forest"
(Family farmer from Santa Marta)

"I think this National Park can be useful for the next generation, for my grandchild to see things that I saw. Animals that today everybody kills. The IBAMA is doing a beautiful job of prohibiting hunting. This is the most beautiful thing that IBAMA does because the people nearly finished off with the animals. But let's preserve what we have. That is useful to everybody in Brazil for now and the future generations.
(Rural Producer with medium level of incomes of Pedra Roxa)

As can be observed, the majority of rural producers have environmental concerns. The rural producers of different categories know the consequences of deforestation, hunting, burning and other practices. The rural producers with high levels of income usually adopt technologies with low environmental impact. The small-scale farms can not adopt the same technologies and have to use fire as the only tool to maintain their livelihood.

5.7 Discussion

The discussion will consider the important issues such as land tenure, fire, benefits, tourism and environment conservation for the villages of Alto Caparaó, Santa Marta and Pedra Roxa.

Problems of land tenure are part of social reality in many different regions of Brazil since colonial period. Also from what was described in chapters one and two, the Brazilian rural landscape consists of a mosaic of *latifundios*, agricultural enterprises with high and medium levels of income, family farmers and different types of small-scale farmers such as peasants, squatters, share croppers, landless and rural workers that exist and interact in different socio-economic circumstances. Land tenure is a social problem that involves all categories of rural producers.

Land tenure is a main problem in the villages around the National Park of Caparao. The different types of land tenure described in this chapter just reflect and reinforce the Brazilian rural reality.

The establishment and management System of National Parks has been adopted by the Brazilian Government, IBAMA is based on the system created and used in the United States and promoted by international conservation agencies such as IUCN as a model of establishment and management of protected areas in the world.

Under this system all land necessary for the establishment of the National Park is purchased and paid for by the Government when the National Park is established, and does not permit permanent residence within the National Park boundaries. Eidsvick (1980), argued that much of American model of National Parks exist where the emphasis is in the protection of nature and where human population is not a major concern.

Similarly, Brazilian legislation does not permit people to make a living inside the National Park areas, yet does not provide the necessary economic compensation as in the American system. This has become the paradox of the Brazilian system of conservation.

The different categories of land tenure created by the establishment of the National Park in the neighbouring areas of Caparaó highlight the exact dimension of the socio-economic impact, especially for small-scale farmers. This is the main problem created by the National Park of Caparaó and the neighbouring rural communities, although it is a problem easily found in most of the Brazilian National Parks. The establishment of the National Park attempts to solve pressing ecological

issues, but in fact creates more social problems than there were previously. Consequently many of the areas are more vulnerable to human interference than before the establishment of the protected areas. This constitutes the ecological paradox of most Brazilian National Parks.

The national park of Caparaó fragmented the communities in Santa Marta and Pedra Roxa. Many farmers did not receive any economic compensation for their lands and had just two alternatives - to migrate to other regions or to remain and keep their land without cultivation. The farmers, who had other sources of income such as a retirement pension, stayed in the communities whilst the others migrated.

The expansion of the boundaries of the National Park also reduced the agricultural areas of the villages. Those areas located in the area of expansion, especially Pedra Roxa, belong to small-scale farmers who are dependent on coffee production. Thus self-sufficient communities became impoverished peasants.

As in other Brazilians National Parks, the land tenure in Caparaó makes many traditional life styles "illegal activities", and since many farmers are not compensated for the loss of land they become enemies of the conservation initiative. This situation can be observed in Santa Marta and Pedra Roxa especially in areas of subsistence production. It evident that the policies establishing and managing the National Parks have few connections with social reality in Brazil.

The use of fire is an ecological and social phenomenon in almost all-Brazilian territory. The ancient practice of burning and clearing new areas for agriculture or pasture has been used in Brazil since the XVI century, but in Caparaó it is no longer possible.

Fire is the most utilised tool for all categories of rural producers around the National Park of Caparaó. The small-scale farmers use fire due to its low cost and the mountainous topography of the region does not constitute a problem. The fires usually occur at the end of the dry season (August/September) thus making the land available for pastures and plantations. Arson also occurs, and it can be difficult to distinguish between a fire lit for clearance purposes or that of a malicious nature. Arson is used by the rural producers to protest against land tenure, fines and lack of dialogue with IBAMA.

There is a vicious circle of fines and fire around Caparaó. The farmers receive a fine and then set fire onto a neighbours' land as revenge. This type of fire is very common in different villages and reflects well the actual situation of the National Park.

In the National Park of Serra da Canastra, before the establishment of the Park, farmers of different categories used fire to clean the pastures. In 1980 due to conservationist pressure, IBAMA did not solve land tenure and expelled all farmers from the area. At the moment fire is still used by small-scale farmers in the neighbouring areas of the Park due to the low cost of maintenance of pastures and, so every year, the fire damages the Park (OLIVEIRA, 1992).

There are no programmes in the National Park to reduce the numbers of fires that occur in Caparaó, despite the damage that these fires can bring to the ecosystems within the National Park.

A few rural producers with high levels of income consider the National Park of Caparaó a benefit. The benefits arise for those with activities linked to the conservation of natural resources such as trout farming and bee keeping. The benefits

that all rural producers and politicians from Espiríto Santo expect are better roads linking Ibitirama to Vitoria and Belo Horizonte.

The small-scale farmers consider the Park as a threat to their survival. The peasants and family farmers in this study are permanently scared that the expansion of the Park will reduce their small properties. Thus self-sufficient communities became impoverished peasants by the Park expansion.

Moreover, the view that the small-scale farmers have about the National Park is linked to the issues of land tenure and fines. Thus, for these farmers the Park does not contribute to the development of the region or to their benefit.

At the present the National Park of Caparaó is the only National Park in Minas Gerais that generates income, due to the tourist paying to visit the park. In Alto Caparaó many large farmers are also tourist entrepreneurs and the different tourist activities provide an important source of income for Alto Caparaó. However, the population of Alto Caparaó claim that they have to pay the entrance fee whereas that they should be allowed free entrance.

There is no entrance to the Park allowed by IBAMA in Espírito Santo. The local population would like to have an entrance in Santa Marta for local population and tourists.

In other villages around the National Park there are no tourist activities, despite the presence of many natural attractions. The local communities in Santa Marta and Pedra Roxa consider that the development of tourism could act to alleviate many of the present conflicts with the National Park, and also aid in the development of the region.

Environmental knowledge is transmitted orally to different generations of rural producers and does not emanate from conservationist or Park management sources. The techniques and environmental concerns are mainly linked to coffee and cattle raising production. Coffee production is the main indicator of different techniques of environmental conservation, and the resulting production levels determine whether the farmers adopt or reject the technique.

Local knowledge of medicinal plants can be of local or even global importance leading to the discovery of new drugs. Also the cultural values of wild foods that have a symbolic significance for these communities could be preserved: prohibiting access will prevent future generations from recognising the food value of some species or remembering methods of processing them. This would avoid a degradation of vital crop genetic resources which results from prohibition of human use of the forest (WOOD, 1995). Alto Caparaó, Santa Marta, and Pedra Roxa there is a traditionally large consumption of local medicinal plants. Additionally, there is a significant consumption of *Eutherpe edulis* (palmito) during the Easter holidays as a substitute for meat in the Catholic diet.

Many traditional conservationists believe that there is an inverse relationship between human actions and environmental conservation (WOOD,1995). However, there is no evidence of this conservationist belief villages around the National Park of Caparaó. Additionally, erosion and absence of rains add to their diary concerns. The preservation of Pico da Bandeira is considered as essential for all farmers of Caparaó although some of them do not agree with IBAMA policy to protect it.

5. 8 Summary

The National Park of Caparaó was created to cater for local claims in order to protect Pico da Bandeira as a symbol of the region.

However, the problem of land tenure, fire and lack of a development programme for the region has turned this protected area into a threat to the survival of peasants and family farmers.

Continuing the study of the impact of National Parks on the local communities, the next chapter will consider the National Park of Grande Sertão Veredas.

CHAPTER 6

Agricultural Production in the Neighbouring Villages to the National Park of Grande Sertão Veredas and Producer Categories

This chapter is organised into two main parts: the structural characteristics of agricultural production in settlements of Chapada Gaúcha, Vereda Santa Rita, Carinhanaha, Barbatimão, Galdino, Rio Preto and Batista which are influenced by the Park and examination of rural producer categories. As indicated in the previous chapters, there are different categories of rural producers around the National Parks in Brazil and these categories have different and sometimes unique relationships with the Parks. In order to understand these categories, the relationship of each village will be described and the different categories of rural producer defined.

6.1 Chapada Gaúcha

The advance of the agricultural frontier westwards of Brazil in the sixties, with the occupation of new lands for agriculture, led to the opening up of savannah land in the state. In 1977 the Foundation of Colonisation and Development in Minas Gerais (Fundação Mineira Colonização e Desenvolvimento) RURALMINAS decided to commercialise land that belonged to Minas Gerais State to promote the expansion of agriculture.

To commercialise the land in the frontier areas, RURALMINAS contracted a private enterprise in Rio Grande do Sul, the Company of Land Colonisation from

Rio Grande do Sul(Comercial Riograndense de Terras e Colonização Limitada. Thus PADSA was created, the Programme of Directed Colonisation of Serra das Araras (Programa de Assentamento Dirigido da Serra das Araras) , with an area of 31428 hectare in the Municipalities of Januaria (18315 ha), Arinos (8542 ha), São Francisco (3120 ha) and Formoso (1453ha).

This program were designed to provide for smallholders and family farmers from Rio Grande do Sul that sold small farms and came to Minas Gerais to work in the *cerrados*. PADSA divided the land into plots of 750 hectare maximum size and each farmer could buy a plot if they met the following conditions: a) they had experience in agriculture b) they had economic conditions to set up in the area c) they agreed to set up the project prepared by Rioterco. In this way PADSA was constituted with 62 plots and 110 farmers in 1977.

In the beginning, when PADSA was just starting to develop, the financing agency Rioterco went bankrupt and RURALMINAS had to assume all the responsibilities of the PADSA. The delay in building the infrastructure led to conflicts between farmers and RURALMINAS. Finally, at the beginning of 1980 the road was opened, a well was dug and a warehouse was erected.

Using the same level of organisation that was used in Rio Grande do Sul, the farmers opened a Co-operative for marketing the agricultural products, providing inputs, credit and rural extension.

In 1994 the Municipality of Formoso exchanged land with the Municipality of São Francisco for the construction of a road. After this exchange, all of PADSA's lands passed to the São Francisco municipality. In 1995 São Francisco emancipated PADSA and it passed to the municipality of Chapada Gaúcha.

As in other many programs of development in *cerrados*, Soya beans became the main products in Chapada Gaúcha. Due to its economic importance, Soya became a currency in Chapada Gaúcha. All economic deals for business are made in bags of Soya, for example. The workers are paid in bags of Soya beans for planting and harvesting. Except for one, all of the farmers in the settlement of Chapada Gaúcha are associated with the co-operative which sells their production, gives technical assistance, buy inputs with best prices as fertilisers, seeds, pesticides, and manages the telephone and water services in the settlement. The Soya production during 1993-1994 was 15520 tons and it was marketed in Brasília over 300 km away.

The Soya consumes a large amount of industrialised inputs in the form of fertilisers, limestone, and insecticides, herbicides that are used by all categories of rural producers.

Due to the lack of water in the majority of lands of Chapada Gaúcha, the farmers transport water in tractors or small lorries from the well located in the settlement.

To harness the potential of the rainy season, the Soya is planted at the beginning of the season and harvested in April. The planting and harvesting requires the effort of almost all the community during this period. The Soya is mechanically planted. During the period of planting the tractors and machinery operates twenty-four hours a day with just a change of operator. Equally, they also harvest with machinery for twenty four hours a day.

The system of production adopted by the farmers in Chapada Gaúcha, with intense use of machinery, make it possible to observe an intense level of erosion in some areas of Soya plantations. Consequently, some farmers have formed terraces to

hold the soil.

Rice is the second most important crop planted in Chapada Gaúcha. The rice is planted in the flood areas or in dry areas of some other locations. During 1993-1994, the co-operative marketed 332 tons of rice produced in Chapada Gaúcha.

The system of production utilised, as with Soya, is completely mechanised, with high consumption of industrialised inputs (fertilisers, insecticides, limestone, and herbicides). The rice is stored and cleaned by of co-operative.

The rearing of farm chickens in Minas Gerais increases the demand of corn in the north west of the state. Corn has now become another item of production in Chapada Gaúcha, and the farmers plant corn along with Soya. They utilise the same fertilisers as Soya beans to plant corn.

The search for new lands by farmers in Chapada Gaúcha led the farmers to deforest large areas and transform the wood into charcoal. They even take the roots and trees and transform them into charcoal.

6.2 Socio-economic characterisation of rural producers in Chapada Gaúcha

Using the 8 variables described in the previous chapter, interviewees were classified into 4 categories, which are identified in the next section. The main objective is to characterise the general features of each category in terms of size of area, Annual Gross Value of Agricultural Production, Gross Value of Commercialised Production, type of labour, other economic activities, schooling level, use of industrialised inputs and use of machinery.

6.2.1 Family producers

There are two family producers in Chapada Gaúcha. They have properties with areas of between 50 and 100 hectares.

The main crop is Soya bean produced in a system of intensified agriculture.

They have a Gross Value of Agricultural Production between 1000 and 6000U$. They market all production and buy all inputs although the Pioneira Co-operative.

The family producers do not utilise contracted labour. On the other hand they work for other farmers in the region assisting them in the preparation of the soil or during the Soya harvest. Both producers have a primary level of education (Table 6.1).

As with others farmers in Chapada Gaúcha, they use large amounts of industrialised inputs such as fertilisers, selected seeds, pesticides.

Table 6.1. Socio-economic categories of rural producers of Chapada Gaúcha state of Minas Gerais. GVAP = Gross value of agricultural production; GVCP=Gross value of commercialised production; TFL=Total family labour; TLP = Total labour of the property.

Variables	Socio-economic categories									
	A (N=)		B (N=)2		C (N=)4		D (N=)13		Total (N=)19	
	n	N/n (%)	n	N/n (%)	n	N/n (%)	n	N/n (%)	N	N/n (%)
Property area (ha)										
< 50	-	-	-	-	-	-	-	-	-	-
50 — 100	-	-	2	100	-	-	1	7.6	3	15.8
100 — 500	-	-	-	-	3	75	8	61.5	11	57.9
500 — 1 000	-	-	-	-	1	25	-	-	1	5.3
1000 —5000	-	-	-	-	-	-	4	30.8	4	30.8
> 5000	-	-	-	-	-	-	-	-	-	
GVAP - US$										
< 1000	-	-	-	-	-	-	-	-	-	-
1000 — 6000	-	-	2	100	-	-	-	-	2	10.5
6000 — 18000	-	-	-	-	4	100	-	-	4	21.1
> 18000	-	-	-	-	-	-	13	100	13	68.4
GVCP/GVAP										
< 50 %	-	-	-	-	-	-	-	-	-	-
50 — 60%	-	-	-	-	-	-	-	-	-	-
60 — 80%	-	-	-	-	-	-	-	-	-	-
> 80%	-	-	2	100	4	100	13	100	19	100
TFL/TLP										
< 40%	-	-	2	100	2	50	5	38.5	9	47.4
40 — 55	-	-	-	-	2	50	2	15.4	4	21.1
55 — 70	-	-	-	-	-	-	-	-	-	-
> 70	-	-	-	-	-	-	6	46.2	6	31.2
Other activities										
yes	-	-	-	-	2	50	5	38.5	7	36.5
No	-	-	2	100	2	50	8	61.5	12	63.2
Education level										
no schooling	-	-	-	-	-	-	-	-	-	-
Primary	-	-	2	100	4	100	11	84.6	17	89.5
Secondary	-	-	-	-	-	-	1	7.6	1	7.6
University	-	-	-	-	-	-	1	7.6	1	7.6
Inputs										
Fertilisers	-	-	2	100	4	100	13	100	19	100
Selected seeds	-	-	2	100	4	100	11	84.6	17	89.5
Pesticides	-	-	2	100	4	100	13	100	19	100
Vaccines	-	-	-	-	4	100	8	61.5	12	63.1
Animal feed	-	-	-	-	-	-	-	-	-	-
Seedling	-	-	-	-	-	-	-	-	-	-
Machinery										
Posses	-	-	1	50	4	100	12	92.4	18	94.7
Rents	-	-	1	50	2	50	1	7.6	4	21.0
does not use	-	-	-	-	-	-	-	-	-	-

One family producer has a tractor the other rents machinery to plant and harvest crops.

6.2.2 Rural Producers with Medium Level of Incomes

There are four rural producers with a medium level of income; the main crops produced are Soya, rice, corn, beans and livestock including cattle raising. All farmers have a Gross Value of Agricultural Production of between 6000 and 18000U$. They also market 80% of their production though the Co-operative.

In this category of rural producers there is a combination of family labour and contracted workers.

Fifty per cent of these farmers have other economic activities linked to commerce. One has a shop and another has a supermarket. All rural producers have primary level of education.

All farmers use large amounts of industrialised inputs such as pesticides, limestone, selected seeds and vaccines (Table 6.1). They buy these materials, as do others, from the Co-operative. Moreover they utilise the co-operative service of rural extension, and they also utilise the co-operative for all their machinery supplies.

All farmers possess machinery such as tractors ploughs spray guns, etc. However half of the rural producers of this category have to rent machinery for the Soya harvest.

6.2.3 Rural Producers with high level of income

There are 13 farmers characterised as rural producers with a high level of income. All rural producers have Gross Value of Agricultural Production above U$18000 per year. They market over 80% of all agricultural production. As with the rural producers in other categories, they market though the co-operative.

Rural producers with a high level of income in Chapada Gaúcha produce Soya beans as the main product with rice, corn and cattle raising.

Most of them (46.2%) utilise family labour as the main source of labour on the property. The others use a mixture of family labour and salaried workers. Most of these rural producers do not have any other economic activity and 84.6% of them have primary education, 7.6% have secondary education and 7.6% have University (table6.1).

The system of production adopted by farmers in this category has led to a large consumption of industrialised inputs. Fertilisers are the most utilised followed by herbicides, insecticides, fungicides, selected seeds and vaccines.

All rural producers utilise machinery and equipment. One of them rents out machinery and equipment. Due to an excessive use of mechanisation, large areas of erosion can be observed. The farmers are attempting to solve this problem by employing techniques of soil conservation, such as terraces, crop rotation and contour planting recommended by the agronomist contracted by the co-operative.

6.3 Chapada Gaúcha and National Park of Grande Sertão Veredas

Just after the creation of the Park, IBAMA sent a representative to Chapada Gaúcha to make contact with the farmers whose land would be expropriated. This representative prohibited the use of land for activities such as hunting, production of charcoal, pesticides in the area of the Park. This first IBAMA representative did not have the necessary diplomacy to make good contacts and caused many conflicts treating the farms with fines.

Some rural producers of Chapada Gaúcha had land located inside of the borders of the Park. These rural producers have valid documents for their lands but did not receive any economic compensation. Some of them were forbidden to use pesticides on their lands because the lands were located at the sources of the rivers. The others still remaining continue producing on their lands, but they cannot use fire or strong pesticides, as in other areas of Chapada Gaúcha.

In order to improve the relationship with the community, IBAMA now employs two student teachers to give talks in the primary schools of the municipality about environmental education. IBAMA representatives also participate in other events such as environmental day, trees day etc. However, IBAMA do not have any development program addressed to the rural producers in the different categories.

The rural producers with high levels of income of Chapada Gaúcha have environmental concerns and look to maximise the natural resources of their farms especially soil and water, that are the environment components most damaged by the type of agriculture adopted by these farmers.

6.4 Vereda Santa Rita

Vereda Santa Rita is an area of *veredas* surrounded by *cerrados* located inside the National Park of Grande Sertão Veredas. Despite the location some rural producers still live in the National Park.

The area is an immense *vereda* with several sources of water and small rivers within the borders of the Park. There is a small settlement inhabited by *caboclos* who have lived for hundred of years in the region. They live in houses without water supply or electrical power which they have built by themselves out of clay and savannah wood. The roofs of the houses are covered with *buriti* palm tree leaves.

Over the past years there have been intense land tenure disputes between the families in the region. Members of one large family disputed the land ownership. The "winners" of the dispute still reside in Santa Rita and the "losers" now live in Chapada Gaúcha and Batista village.

There are two rural producers from Chapada Gaúcha who owned land in Vereda Santa Rita. One farmer had 100 ha in Vereda Santa Rita for the production of irrigated beans. They have a system of irrigation with a central pivot, but after the establishment of the National Park, they have been prohibited from using insecticides and herbicides. As a consequence they decided stop the cultivation and to wait for economic compensation for the lands and the irrigation system.

The traditional population, with land located in the *veredas* plant subsistence crops. They cultivate the *veredas* to produce crops such as rice, beans, corn, sugar cane, and manioc. They clear the native vegetation and utilise the organic matter as

fertiliser.

The population living in dry areas prepares the land in a system of clearing and burning, using the ashes from the native vegetation as fertiliser. This is a savannah form of slash and burn agriculture. They use tools made by themselves from native vegetation.

They also use the natural vegetation of *veredas* and dry lands as pastures for cattle. In both cases they light fires to clean the pastures in the dry season (April to October) and then use the area for the rest of the year.

6.5 Socio-economic characterisation of rural producers in Vereda Santa Rita

Using the 8 variables described in the previous chapter, interviewees were classified into 4 categories, which are identified into the follow sections. The main objective is to characterise each category in terms of area, Annual Gross Value of Agricultural Production, Gross Value of Commercialised Production, type of labour, other economic activities, schooling level, use of industrialised inputs and use of machinery.

6.5.1 Peasants

There are 4 rural producers categorised as peasants in Vereda Santa Rita. Seventy five per cent of rural producers have areas smaller then 50 ha and have possession of land. One of these rural producer owns an area between 100 and 500

ha. The peasants of this category have a Gross Value of Rural Production smaller than U$1000 p.a.

They produce subsistence crops and the main products are rice, beans, corn, banana, and manioc. One farmer rears some cattle extensively on the natural pastures. As a group, they market less than 40% of production and they use a barter system to exchange goods with relatives, neighbours and friends.

They utilise family labour and manual tools as the only source of labour for all activities. Half of these rural producers have another economic activity and 75% of them are illiterate with only 25% having a primary education.

They do not use industrialised inputs in the agricultural production and they utilise a system of slash and burn on the riverine and flood plains in the *veredas.*

Table 6.2. Socio-economic categories of rural producers of Vereda Santa Rita state of Minas Gerais. GVAP = Gross value of agricultural production; GVCP=Gross value of commercialised production;TFL =Total family labour; TLP = Total labour of the property.

Variables	Socio-economic categories									
	A (N=) 4		B (N=)		C (N=)		D (N=)		Total (N=) 4	
	n	N/n (%)	n	N/n (%)	n	N/n (%)	n	N/n (%)	n	N/n (%)
Property area (ha)										
< 50	3	75	-	-	-	-	-	-	3	75
50 — 100	-	-	-	-	-	-	-	-	-	-
100 — 500	1	25	-	-	-	-	-	-	1	25
500 — 1 000	-	-	-	-	-	-	-	-	-	-
1000 —5000	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-
GVAP – US$										
< 1000	4	100	-	-	-	-	-	-	4	100
1000 — 6000	-	-	-	-	-	-	-	-	-	-
6000 — 18000	-	-	-	-	-	-	-	-	-	-
> 18000	-	-	-	-	-	-	-	-	-	-
GVCP/GVAP										
< 50 %	4	100	-	-	-	-	-	-	4	100
50 — 60%	-	-	-	-	-	-	-	-	-	-
60 — 80%	-	-	-	-	-	-	-	-	-	-
> 80%	-	-	-	-	-	-	-	-	-	-
TFL/TLP										
< 40%	-	-	-	-	-	-	-	-	-	-
40 — 55	-	-	-	-	-	-	-	-	-	-
55 — 70	-	-	-		-	-	-	-	-	-
> 70	4	100	-	-	-	-	-	-	4	100
Other activities										
Yes	2	50	-	-	-	-	-	-	2	100
No	2	50	-	-	-	-	-	-	2	100
Education level										
No schooling	3	75	-	-	-	-	-	-	3	75
Primary	1	25	-	-	-	-	-	-	1	25
Secondary	-	-	-	-	-	-	-	-	-	-
University	-	-	-	-	-	-	-	-	-	-
Inputs										
Fertilisers	-	-	-	-	-	-	-	-	-	-
Selected seeds	-	-	-	-	-	-	-	-	-	-
Pesticides	-	-	-	-	-	-	-	-	-	-
Vaccines	-	-	-	-	-	-	-	-	-	-
Seedlings	-	-	-	-	-	-	-	-	-	-
Animal feed	-	-	-	-	-	-	-	-	-	-
Machinery										
Possesses	-	-	-	-	-	-	-	-	-	-
Rents	-	-	-	-	-	-		-	-	-
Does not use	4	100	-	-	-	-	-	-	4	100

Based in survey in 1994

6.6 Vereda Santa Rita and National Park of Grande Sertão Veredas

As in other traditional settlement in the North of Minas Gerais, Vereda Santa Rita was a communal area occupied by peasants that plant subsistence crops in a system of low impact agriculture and use the communal areas to raise cattle. The market relations are limited to sell the excedent and buy what they do not produce such as oil, salt and clothing.

Santa Rita is closely linked to Chapada Gaúcha because before the building of the well, the farms of Chapada Gaúcha used to collect water in the Santa Rita river. Also the first farmers arriving from South of Brazil came to collect samples of banana tree, sugar cane, medicinal plants and to offer jobs on their farms to the local population.

Some rural producers of Chapada Gaúcha have areas in Vereda Santa Rita. One of these rural producers gave up production because IBAMA representatives have forbidden the use of pesticides in the National Park, the other utilises the natural pastures for cattle raising.

The majority of rural producers of Vereda Santa Rita have valid documents but have not received economic compensation. In addition FUNATURA keeps a ranger who is related to the farms to watch the area of the National Park and is the link between the IBAMA representatives and local population.

Santa Rita is a strategic point in the National Park because it is the most utilised entrance to the Park for people that came from Chapada Gaúcha. Also through Santa Rita it is possible to reach the other settlements located in the Park such as Carinhanha, Barbatimão and Rio Preto.

6.7 Carinhanha

The expansion of agricultural frontiers in Minas Gerais brought some urban entrepreneurs to invest in land in the north west of the state. Carinhanha is a large area that belongs to a enterprise from Sao Paulo state.

Carinhanha has an area of 18000 ha located inside of the National Park of Grande Sertão Veredas, and it is considered a *latifundio.* Before the establishment of the National Park the owners invested heavily in planted pastures and an infrastructure for cattle production. They intended to transform Carinhanha into a very profitable livestock enterprise. After the establishment of the National Park, the land was rented by a group of entrepreneurs from the South of Minas Gerais and they have not invested in further improvements in the area.

The headquarters of Carinhanha has electrical power and water supply, a lodging area for temporary workers, houses for permanent workers and storage rooms.

As other *latifundios* Carinhanha is surrounded by peasant farmers who live on the farm. Some of them used to be employed in Carinhanha, one being a cowboy and another a tractor operator. Some ex-workers get temporary jobs from the farm cleaning the pastures or as cooks.

The smallholders plant subsistence crops such as rice, beans, corn, manioc and sugar cane. They also produce some handcrafts utilising *buriti* palm leaves as *esteiras* and hats that they occasionally sell.

They plant subsistence crops and have constructed drains in the *veredas.*

They fire the pastures during the dry season and wait until the rainy season to plant the crops using the organic matter as fertiliser.

The peasants also live in rustic house build by themselves. The walls are made of clay drawn from of the riverbeds and native trees whilst the roof is constructed of *buriti* palms . They do not a have water supply or electricity.

The smallholders also have a few chickens and a small number of cattle. The cattle are grazed utilising the natural pastures of the *veredas* or areas of savannah.

6.8 Socio-economic characterisation of rural producers in Carinhanha

The methodology employed in this case study follows the pattern for using the 8 variables as described in the previous chapter. Interviewees were classified in 4 categories, which are identified into the following sections. The main objective is to describe the general characterisation of each category in terms of size of area, annual Gross Value of Agricultural Production, Gross value of Commercialised Production, type of labour, other economic activities, schooling level, use of industrialised inputs and use of machinery.

6.8.1 Peasants

There are 3 rural producers characterised as peasants and they are smallholders of the Carinhanha farm in Onça. They have areas of 50 hectare and produce subsistence crops. They use the areas of *veredas* to produce goods such as beans, rice, manioc, and cane sugar and use the natural pastures for extensive cattle

Table 6.3 Socio-economic categories of rural producers of Carinhanha, state of Minas Gerais. GVAP = Gross value of agricultural production; GVCP = Gross value of commercialised production; TFL = Total fame labour; TLP = Total labour on the property.

Variables	Socio-economic categories									
	A (N=4)		B (N=)		C (N=)		D (N=1)		Total (N=)	
	n	N/n (%)	n	N/n (%)	n	N/n (%)	N	N/n (%)	n	N/n (%)
Property area (ha)										
< 50	3	100	-	-	-	-	-	-	3	75
50 — 100	-	-	-	-	-	-	-	-	-	-
100 — 500	-	-	-	-	-	-	-	-	-	-
500 — 1 000	-	-	-	-	-	-	-	-	-	-
1000 —5000	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	1	100	1	25
GVAP - US$										
< 1000	3	100	-	-	-	-	-	-	3	75
1000 — 6000	-	-	-	-	-	-	-	-	-	-
6000 — 1800	-	-	-	-	-	-	-	-	-	-
> 18000	-	-	-	-	-	-	1	100	1	25
GVCP/GVAP										
< 50 %	3	100	-	-	-	-	-	-	3	75
50 — 60%	-	-	-	-	-	-	-	-	-	-
60 — 80%	-	-	-	-	-	-	-	-	-	-
> 80%	-	-	-	-	-	-	1	100	1	25
TFL/TLP										
< 40%	-	-	-	-	-	-	1	100	1	25
40 — 55	-	-	-	-	-	-	-	-	-	-
55 — 7-0-	-	-	-	-	-	-	-	-	-	-
> 70	3	100	-	-	-	-	-	-	3	75
Other activities										
yes	2	66.7	-	-	-	-	1	100	3	75
No	1	33.3	-	-	-	-	-	-	1	25
Education level										
No schooling	2	66.7	-	-	-	-	-	-	2	50
Primary	1	33.3	-	-	-	-	-	-	1	25
Secondary	-	-	-	-	-	-	-	-	-	-
University	-	-	-	-	-	-	1	100	1	25
Inputs										
Fertilisers	-	-	-	-	-	-	-	-	-	-
Selected seeds	-	-	-	-	-	-	-	-	-	-
Pesticides	-	-	-	-	-	-	-	-	-	-
Vaccines	-	-	-	-	-	-	1	100	1	100
Animal feed	-	-	-	-	-	-	1	100	1	100
Machinery										
Possesses	-	-	-	-	-	-	1	100	1	25
Rents	-	-	-	-	-	-	-	-	3	75
does not use	3	100	-	-	-	-	-	-		

Based in survey in 1994

raising. They have Gross Values of Agricultural Production of less then 1000U$. They do not commercialise any surplus of produce and they exchange goods between themselves. They also make *esteiras* and hats of buriti palm tree and sell them in Chapada Gaúcha.

All labour utilised is family labour ; there is no contracted salaried work. On some occasions, for example at planting or at harvest, they exchange days of work with neighbours or relatives. Two of these rural producers have other activities outside their farms. One, who works is retired and the other works in a charcoal enterprise located in the borders of the National Park.

They do not utilise industrialised inputs on their properties and also utilise a system Raising.

6.8.2 Rural Producers with high level of income

There is one rural producer with a high levels of income. The farm occupies an area of around 18000-hectare. The main economic activity is semi-extensive cattle raising.

The farm has a Gross Value of Agricultural Production over U$ 18000 and over 80% of the production is sold in the market.

The farm raises beef cattle, and when the cattle reach maturity they are taken to the South of Minas Gerais or São Paulo for sale. The cows are kept on the farm for breeding .

All labour on this property is salaried work and the farmer contracts permanent workers to herd the cattle and work with the machinery and temporary

workers to clean the pastures.

The farm consumes large amounts of industrialised inputs related to cattle raising, including vaccines, salt and fodder. Tractors are used for maintaining the internal roads of the property.

6.9 Carinhanha and the National park of Grande Sertão Veredas

Carinhanha is part of an agroindustrial complex located in São Paulo state called Feltrin Agro Industrial. Feltrin Agro Industrial has tax debts of with Institute National of Social Security (Instituto Nacional de Securidade Social) IBAMA and Feltrin Agro industrial is studying a proposal to convert this debts into land expropriated by the National Park.

The system of production in Carinhanha is extremely traditional in the region with peasants occupying communal lands to keep cattle and working in the *latifundios* to market needs. Peasants that live in Vereda Onça surround the lands of Carinhanha. The National Park expropriated part of the peasants' lands and they expect to receive compensation although Feltrin Agro Industrial because they do not have valid documents. For these producers it will be difficult to keep their livelihood because IBAMA representatives prohibited them from deforesting new areas to plant subsistence crops or use fire to clean native pastures. Last year, IBAMA representatives threatened to fine a peasant because he set a fire in a piece of *vereda* in order to plant subsistence crops in the borders of the National Park with permission from the ranger of FUNATURA.

The workers that used to work in Carinhanha lost their jobs as a tractor

operator and cowboy and now work as a woodcutter in a charcoal merchant located in the borders of the Park. These workers also lost the social benefits that they had when they worked in Carinhanha.

6.10 Barbatimão

Barbatimão is a small settlement located in the borders of Bahia state in the municipality of Formoso. It is bounded by the Carinhanha river and is located inside the National Park of Grande Sertão Veredas.

Producers live in rustic houses built by themselves using clay from the Carinhanha riverbed and wood from corrode trees with roofs made from *buriti* palm leaves. The furniture is also made up from *buriti.* They do not have a water supply or electricity.

There is a primary school in the community and the teacher is the son of one of the smallholders on the settlement.

As in other settlements in this study, the smallholders produce subsistence crops such as beans, rice and sugar cane. One of them sells *rapadura* and *melado* occasionally produced on the farm.

The peasants use the riverbank and select an area that will not be completely flooded in the rainy season. Thus, the vegetation is cleared and burned and at the beginning of the rainy season the crops are planted. The harvest occurs before the dry season. Natural fertilisation by river deposits permits the use of same adjacent riverine areas for many years.

The farmers also have a small herd of cattle grazed on native pastures. The pastures are cleaned with fire at the end of the dry season for growing in the rainy season. The herd is used as an insurance against unexpected demands and also to make donations to religious parties such as *folias de reis.*

6.11 Socio-economic characterisation of rural producers in Barbatimão

Using the 8 variables as described in the previous chapter, interviews were classified in 4 categories that are identified in the follow sections by letters. The main objective is to describe the general characterisation of each category in terms of size of area, annual Gross Value of Agricultural Production, Gross value of Commercialised Production, type of labour, other economic activities, schooling level, use of industrialised inputs and use of machinery.

6.11.1. Peasants

5 farmers classified as peasants make up this category. They are owners of areas less than 50 hectare in size and produce at subsistence level rice, beans, corn, sugar cane and manioc together with extensive cattle raising.

They have a Gross Value of Agricultural Production above U$ 1000 and do not sell the produce. They exchange goods with neighbours and relatives. One peasant occasionally sells cane syrup and *rapadura.*

Family labour is the only source of labour in these communities. Forty per cent of these rural producers have other activities off their farms. Around 80% of

Table 6.4 Socio-economic categories of rural producers o f Barbatimão, state of Minas Gerais GVAP = Gross value of agricultural production; GVCP = Gross value of commercialised production; TFL = Total family labour; TLP = Total labour on the property.

Variables	Socio-economic categories									
	A (N=)5		B (N=)		C (N=)		D (N=)		Total (N=5)	
	n	Nn	n	N/n	n	N/n	n	N/n	n	N/n
Property area (ha)										
< 50	5	100	-	-	-	-	-	-	5	100
50 — 100	-	-	-	-	-	-	-	-	-	-
100 — 500	-	-	-	-	-	-	-	-	-	-
500 — 1 000	-	-	-	-	-	-	-	-	-	-
1000 —5000	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-
GVAP - US$										
< 1000	5	100	-	-	-	-	-	-	5	100
1000 — 6000	-	-	1	100	-	-	-	-	-	-
6000 — 18000	-	-	-	-	-	-	-	-	-	-
> 18000	-	-	-	-	-	-	-	-	-	-
GVCP/GVAP										
< 50 %	5	100	1	-	-	-	-	-	5	100
50 — 60%	-	-	-	-	-	-	-	-	-	-
60 — 80%	-	-	-	-	-	-	-	-	-	-
> 80%	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
TFL/TLP										
< 40%	-	-	-	-	-	-	-	-	-	-
40 — 55	-	-	-	-	-	-	-	-	-	-
55 — 70	-	-	-	-	-	-	-	-	-	-
> 70	5	100	-	-	-	-	-	-	-	-
Other activities										
yes	2	40	-	-	-	-	-	-	2	40
No	3	60	-	-	-	-	-	-	3	60
Education level										
No schooling	4	80	-	-	-	-	-	-	4	80
Primary	1	200	1	100	-	-	-	-	1	20
Secondary	-	-	-	-	-	-	-	-	-	-
University	-	-	-	-	-	-	-	-	-	-
Inputs										
Fertilisers	-	-	-	-	-	-	-	-	-	-
Selected seeds	-	-	-	-	-	-	-	-	-	-
Pesticides	-	-	-	-	-	-	-	-	-	-
Vaccines	-	-	-	-	-	-	-	-	-	-
Animal feed	-	-	-	-	-	-	-	-	-	-
Seedling	-	-	-	-	-	-	-	-	-	-
Machinery										
Possesses	-	-	-	-	-	-	-	-	-	-
Rents	-	-	-	-	-	-	-	-	-	-
does not use	5	100	-	-	-	-	-	-	5	100

Based in survey in 1994

these rural producers are illiterate and 20% have primary level of education.

They do not use industrialised inputs or machinery and use manual tools for all agricultural activities these rural producers are illiterate and 20% have primary level of education.

6.12 Barbatimão and National Park of Grande Sertão Veredas

Barbatimão is a settlement located in the borders of Bahia state . Most of the lands of this community are traversed by the Carinhanha river. This feature makes the system of cultivation more productive than the dry lands of other areas.

The community of Barbatimão is one of the most articulate and organised communities inside the National Park. Rural producers with valid titles for their lands mainly compose this community.

The majority of farmers would like to keep the same traditional livelihood, but there is too much pressure from IBAMA representatives to prevent deforestation and use of fire to clean the pastures. As a result one farmer is preparing documents required by IBAMA to sell the lands.

There is a FUNATURA ranger that lives in Barbatimão and reports all land uses in the area to IBAMA representatives.

6.13 Galdino and Rio Preto

This area corresponds to two small settlements linked by a corridor of savannahs and *veredas* inside the National Park.

The farmer who lives in Rio Preto has another area of 900 hectare in Arinos but prefers to live in Rio Preto because there is a lack of water in the other area.

They do not have an electricity or any water supply. The families that live in Galdino have traditional houses made of clay, savannah trees and *buriti* palm. The family that lives in Rio Preto lives in a house built from bricks.

The main activity of the farmers in Galdino is as a ranger in the Park of Grande Sertão Veredas. In both areas the farmers grow subsistence crops such as beans, rice, sugar cane and trees such as mango, orange and avocado.

These farmers also have livestock such as chickens, turkeys and sheep. All livestock graze extensively without any industrialised inputs such as fodder or vaccines.

The main economic activity is cattle raising. They clean the pastures using fire at the end of dry season and they grow their crops in the rainy season.

The farmers also utilise a system of slash and burn on the natural vegetation and plant in the flooded areas using the natural fertilisation of the rivers.

6.14 Socio-economic characterisation of rural producers in Galdino and Rio Preto

Using the 8 variables described in the previous chapter interviewees were classified in 4 categories which are identified in the following sections. The main objective is to describe the general characterisation of each category in terms of size of area, annual Gross Value of Agricultural Production, Gross value of Commercialised Production, type of labour, other economic activities, schooling level, use of industrialised inputs and use of machinery.

6.14.1. Peasants

There are 2 rural producers categorised as peasants. They have areas smaller than 50 ha and grow subsistence goods such as corn, manioc, beans and rice together with extensive sheep, cattle raising and other livestock.

The Gross Value of Agricultural Production is above U$ 1000 and they do not sell the products but exchange goods with neighbours and relatives.

They use family labour as the only source of labour on the farm. Both farmers work as rangers in the National Park contracted by FUNATURA. One is illiterate and the other has a primary level of education (table 6.5).

They do not use industrialised inputs and have manual tools for all farm activities.

Table 6.5. Socio-economic categories of rural producers of Rio Preto e Galdino, state of Minas Gears GVAP = Gross value of agricultural production; GVCP = Gross value of commercialised production; TFL = Total family labour; TLP = Total labour on the property.

Variables	Socio-economic categories									
	A (N=)2		B (N=)1		C (N=)		D (N=)		Total (N=2)	
	n	N/n	n	N/n	n	N/n	N	N/n	n	N/n
Property area (ha)										
< 50	2	100	-	-	-	-	-	-	2	66.7
50 — 100	-	-	-	-	-	-	-	-	-	-
100 — 500	-	-	-	-	-	-	-	-	-	-
500 — 1 000	-	-	1	100	-	-	-	-	1	33.3
1000 —5000	-	-	-	-	-	-	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-
GVAP - US$										
< 1000	2	100	-	-	-	-	-	-	2	66.7
1000 — 6000	-	-	1	100	-	-	-	-	1	33.3
6000 — 18000	-	-	-	-	-	-	-	-	-	-
> 18000	-	-	-	-	-	-	-	-	-	-
GVCP/GVAP										
< 50 %	2	100	1	12.5	-	-	-	-	3	100
50 — 60%	-	-	-	-	-	-	-	-	-	-
60 — 80%	-	-	-	-	-	-	-	-	-	-
> 80%	-	-	-	-	-	-	-	-	-	-
TFL/TLP										
< 40%	-	-	-	-	-	-	-	-	-	-
40 — 55	-	-	-	-	-	-	-	-	-	-
55 — 70	-	-	1	100	-	-	-	-	1	33.3
> 70	2	100	-	-	-	-	-	-	2	66.6
Other activities										
yes	2	100	-	-	-	-	-	-	2	66.7
No	-	-	1	100	-	-	-	-	1	33.3
Education level										
No schooling	1	50	-	-	-	-	-	-	1	33.3
Primary	1	50	1	100	-	-	-	-	-2-	66.7
Secondary	-	-	-	-	-	-	-	-	-	-
University	-	-	-	-	-	-	-	-	-	-
Inputs										
Fertilisers	-	-	-	-	-	-	-	-	-	-
Selected seeds	-	-	-		-	-	-	-	-	-
Pesticides	-	-	-	-	-	-	-	-	-	-
Vaccines	-	-	1	100	-	-	-	-	1	100
Animal feed	-	-	-	-	-	-	-	-	-	-
Seedling	-	-	-	-	-	-	-	-	-	-
Machinery										
Possesses	-	-	-	-	-	-	-	-	-	-
Rents	-	-	-	-	-	-	-	-	-	-
does not use	2	100	1	100	-	-	-	-	3	100

Based in survey in 1994

6.14.2. Family Farm

There is one rural producer categorised as a family farm. This rural producer produces subsistence crops such as manioc, corn, beans and rice and raises livestock. He also adopts a system of extensive cattle raising for beef production

This farmer has Gross Value of Agricultural Production between 1000 and 6000U$. He sells less then 50% of the production, all cattle produced are kept in the farm as a form of investment.

The farm adopts a mixture of family labour and a contract agreement with a relative working as a cowboy on the farm. This farmer does not have any other economic activity and has a primary level of education.

The only input utilised by this farm is cattle vaccine and there is no mechanisation.

6.15 Galdino and Rio Preto and their relationship with the National Park

Galdino is one of few areas in the National Park that had been economically compensated and is occupied by a FUNATURA ranger and his family.

Rio Preto is an area that is part of the heritage of the biggest *latifundio* of Minas Gerais state. As in many other *latifundios* in Minas Gerais, before the establishment of the National Park there were many land conflicts and the landlord used to hire armed contract killers to expel squatters of his lands.

At the moment IBAMA is studying a proposal to exchange the lands of Rio Preto with areas outside of the Park where charcoal can be exploited. Thus, IBAMA will solve land tenure in a large area without paying compensation for the land. Last year the family that occupied Rio Preto lost 32 young bulls that had been attacked by wolves or panthers.

6.16 Batista

Batista is a settlement located in the municipality of Arinos. It is located at the borders of National Park. It has a primary school at the settlement and the teacher comes from Arinos.

This settlement has some smallholders and one larger scale farmer. The smallholders live in houses built of clay, savannah trees and *buriti* palm leaves. They do not have electricity or water supply. The farmer lives in a modern house with a water and electrical power supply.

The smallholders produce crops by a system of slash and burn of the native vegetation. They plant subsistence crops including rice , beans ,corn and sugar cane and also produce manioc and manioc flour for sale.

Beef cattle are the principal economic activity for these farmers. The cattle are grazed extensively and act at the same time as a reserve. The pastures are maintained with fire at the end of the dry season, regenerating rapidly in the rainy season.

6.17 Socio-economic characterisation of rural producers in Batista

Using the 8 variables decried in the previous chapter, interviewees were classified into 4 categories, which are identified into following. The main objective is to characterise of each category in terms of size of area, annual Gross Value of Agricultural Production, Gross Value of Commercialised Production, type of labour, other economic activities, schooling level, use of industrialised inputs and use of machinery.

6.17.1 Peasants

This category is composed of 3 farmers. They produce corn, beans, rice, manioc, sugar cane at a subsistence level, together with livestock and beef cattle raising and have Gross Value of Agricultural Production above 1000U$. They just sell any product surplus to requirements in the neighbourhood and the present *eucalyptus* reforestation project permits them to sell chickens and eggs locally.

They use family labour as their main source of labour on the farms. They also use female labour for preparing manioc floor and masculine labour for exchange in cleaning pastures.

Table 6.6 Socio-economic categories of rural producers of Batista state of Minas Gerais GVAP = Gross value of agricultural production; GVCP = Gross value of commercialised production; TFL = Total family labour; TLP = Total labour on the property.

Variables	Socio-economic categories									
	A (N=3)		B (N=)		C (N=1)		D (N=)		Total (N=4)	
	n	N/n	n	N/n	n	N/n	n	N/n	n	N/n
Property area (her)										
< 50	2	66.7	-	-	-	-	-	-	2	50
50 — 100	-	-	-	-	-	-	-	-	-	-
100 — 500	1	33.3	-	-	-	-	-	-	1	25
500 — 1 000	-	-	-	-	-	-	-	-	1	25
1000 —5000	-	-	-	-	1	100	-	-	-	-
> 5000	-	-	-	-	-	-	-	-	-	-
GAP – US										
< 1000	3	100	-	-	-	-	-	-	3	75
1000 — 6000	-	-	-	-	-	-	-	-	-	-
6000 — 18000	-	-	-	-	1	100	-	-	1	25
> 18000	-	-	-	-	-	-	-	-	-	-
GVCP/GVAP										
< 50 %	3	100	-	-	-	-	-	-	3	75
50 — 60%	-	-	-	-	1	100	-	-	1	25
60 — 80%	-	-	-	-	-	-	-	-	-	-
> 80%	-	-	-	-	-	-	-	-	-	-
TFL/TLP										
< 40%	-	-	-	-	-	-	-	-	-	-
40 — 55	-	-	-	-	1	100	-	-	1	25
55 — 70	-	-	-	-	-	-	-	-	-	-
> 70	-	-	-	-	3	100	-	-	3	75
Other activities										
yes	-	-	-	-	1	100	-	-	1	25
No	3	100	-	-	-	-	-	-	3	75
Education level										
No schooling	2	66.7	-	-	-	-	-	-	2	50
Primary	1	33.3	-	-	1	100	-	-	2	50
Secondary	-	-	-	-	-	-	-	-	-	-
University	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
Inputs										
Fertilisers	-	-	-	-	-	-	-	-	-	-
Selected seeds	-	-	-	-	-	-	-	-	-	-
Pesticides	-	-	-	-	-	-	-	-	-	-
Vaccines	-	-	-	-	1	100	-	-	1	100
Animal feed	-	-	-	-	-	-	-	-	-	-
Seedling	-	-	-	-	-	-	-	-	-	-
Machinery										
Possesses	-	-	-	-	-	-	-	-	-	-
Rents	-	-	-	-	-	-	-	-	-	-
does not use	3	100	-	-	1	100	-	-	4	100

Based in survey in 1994

They do not utilise industrialised inputs in the production or machinery.

6.17.2.Rural Producer with medium level of income

There is one rural producer characterised as a rural producer with a medium level of income. This farmer has an area of 3000 hectare divided into 2 properties. There is some production of subsistence crops such as beans, rice , corn, cane sugar but the main economic activity is extensive beef cattle raising.

The Gross Value of Production of this property is between 6000 and 18000 U$ and between 50 and 60 % of the production is sold.

There is a combination of contracted and family labour. The family labour is used for the subsistence crops and the contracted labour for the beef cattle production. This farmer is also the owner of a shop in Belo Horizonte and has a primary level of education.

The only input utilised by this farm are vaccines for the cattle and there is no mechanisation.

6.18 The Villages and the National Park of Grande Sertão Veredas

Batista is a settlement located in a dry area of Arinos, the majority of small-scale farmers that have land in Arinos are related to farmers in Vereda Santa Rita. Despite the environmental differences between these two areas there are many cultural links between then.

All farms of different categories utilise fire as the main tool to prepare the soil to plant subsistence crops and clean the pastures. IBAMA representatives watch Batista because there are large fires in the dry season.

The capitalised farms of Chapada Gaúcha do not lose substantial parts of their lands to the establishment of the National park of Grande Sertão Veredas. Just one farmer of Chapada Gaúcha lost the main area of cultivation of his farm. The others farmers lost areas on the borders of their properties

The region of *Gerais* had been colonised by large farms with peasant communities on the banks of rivers. The peasants occupied the plateaux as communal lands to keep animals and to extract natural resources to provide subsistence. The large farms provide the seasonal work-herding cattle for peasants. Thus, it could be observed that the establishment of the National Park of Grande Sertão Veredas has deeply modified the relation of production of these communities. In addition the large farms will be economically compensated but the small farms and the peasants that occupied lands without documents in the borders of these areas can not produce in a system of slash burn cultivation, and will not be economically compensated and will probably have to leave the lands of the Park.

The socio-economic impact of the establishment of the National Park of Grande Sertão Veredas will be discussed in the next chapter.

CHAPTER 7

Social impact of the creation of the National Park of Grande Sertão Veredas

In this chapter the socio-economic impact of the creation of the National Park of Grande Sertão Veredas on the villages of Chapada Gaúcha, Vereda Santa Rita, Carinhanha and Onça, Galdino and Rio Preto Barbatimão and Batista will be analysed.

Further, the significance of the creation of the National Park in terms of , land tenure, the use of fire, environmental conservation and expectations of local people in respect of the potential of Park management is also assessed.

7.1 Creation of National Park

Historical records show that more than ten indigenous groups lived in the north of Minas Gerais until the arrival of the Portuguese. The most important group were the Cururus, in the Carinhanha region, the Caioapos and Abatiras in the regions of Pandeiros, Pardo and Urucuia rivers. These indigenous groups lived by fishing, hunting and agriculture (DAYRELL, 1993).

The mixture of agriculture of European and indigenous origins was the basis of the peasant agriculture, which was self sufficient in basic products such as manioc (flour and powder), corn (flour and powder), beans, sugar cane, rice, pumpkins, milk

and meat.

The large cattle farms which evolved over time were located in the fertile banks of rivers (sources and *veredas*) and most of the peasants settlements were located in the gaps between the large farms or in the savannah slopes and plateaux of also called *gerais*. Usually these areas were less fertile and had few uses for the large landlords. The large farms specialised in cattle production to supply the urban centres of the seacoast and areas of mining. The peasants communities also called *geraizeiros* had a productive system based on food, livestock and fibre production and on the collective exploitation of the plateau area (COSTA, 1990). These collective areas were used to keep the cattle after branding. The cattle were the capital reserve of the peasants and small farmers. On these plateau fruits, medicinal plants, wood, fibre for fishing, wood for construction and others natural resources were also collected.

This mode of occupation and the system of organisation developed in a very slow rhythm and led to a land concentrated structure. This caused the appearance of large-scale landlords. The *latifundiarios* exercised their power over submitting squatters, leaseholds, land tenants and small-scale farmers through relationships of fellowship or by violence, depending on how the peasants affected their personal, economic or political interests.

The large farms were a self sufficient economic complex using black slaves or indigenous people as labour. The farms used to raise cattle for the markets. All the peasants were subservient to the *latifundiarios* and were responsible by the subsistence production and by the work with the cattle. The land access for the peasants were relatively easy in the lands without owner in the plateaux and the

partnership with the *latifundiarios* represented a possibility to survive.

After three centuries from 1650 to 1950, the region presented a picture of land concentration; just 6% of farmers had over of 500 ha. each and these areas represented 64% of the total area (GEA, 1993).

At the beginning of the 1980's the *latifundiarios* transformed their farms from cattle raising to rural enterprises with the aim of getting subsidised credit and tax benefits. As a result, the *latifundiarios* adopted the new technologies recommended by the centres of research and rural extension. They also illegally extended the borders of their farms. Consequently, peasants were expelled from their lands by *jagunços* (DAYRELL, 1993).

The communal land of the plateau was grabbed by coal, cattle or reforestation enterprises. These companies did not respect houses, subsistence crops or water sources and *veredas.* This was the social context of the region when the National Park of Grande Sertão Veredas was established

The National Park is located in a region called Gerais. The idea for the name was a tribute to the writer João Guimarães Rosa who wrote a book Grande Sertão Veredas and at the same time tried to protect the ecosystem formed by *veredas* and plateaux of the savannah on the left bank of the São Francisco river.

The idea for the creation of the National Park was born from conservationists from Minas Gerais and Brasília. Federal Decree 97658 of the President of Republic created the National Park on the12th of April 1989. The National Park was justified by lack of conservation for the savannah landscape in the Gerais. The savannahs occupy a quarter of Brazilian land and just 0.6% are protected although units of conservation and the *gerais* represent the last frontier outside the Amazon in Brazil.

The lands located in the National Park were used for extensive cattle raising and charcoal production and latterly for intensive agriculture, predominantly for the production of Soya beans, rice and corn.

On the 9h of August 1991 a contract was signed between IBAMA and FUNATURA with the aim of reducing US$ 2.2 million of Brazilian external debt. The American Nature Conservancy with supervision of IBAMA donated over U$ 850 000 to FUNATURA through Banco do Brasil (Bank of Brazil) Banco do Brasil converts US 132 000 of this money in Reais annually. It corresponds to 6% interest on US 2.2 million during 20 years.

The first payment under the arrangement was made in October 1993 and FUNATURA has the right to receive US 11 000 every month over 20 years, to be used in the National Park. The program to be executed in co-operation with the Nature Conservancy is intended to study biodiversity and the economics of conservation in the *cerrado*. The projects developed at the moment are environmental education, medicine and health.

7.2 Land tenure

The region where the National Park is located is notable for the intense pressure on the land surrounding it. The National Park is surrounded by very large areas of "grab land " and there are many *posseiros (*squatters) living around and inside the Park.

Before the establishment of the Park, there were many conflicts between the

farms of Luciano (27000 ha) and Carinhanha(18000) caused by alterations in the limits and the presence of squatters in Luciano. This conflict mobilised the population of the settlements and many *jagunços* were brought in from other regions of the state to defend the farms. These *latifundiarios* use violence to clear away any local population not possessing legal titles for the land. This can be observed in local opinions:-

*"Carinhanha wanted to fight for the land. They came two times here at home to fight. People came from Belo Horizonte to protect the land of Luciano, everybody sleeps with weapons. They wanted to kill for the land.(*Peasant from Galdino)

The land located on the borders of the large farms and the plateaux is used as communal land by peasants for cattle raising, and wild plant products. These *latifundiarios* also use violence to clear away the local population who did not have legal documents for the land. The local population remembers these conflicts:-

" Carinhanha farm threaten much, the biggest problem for us was Carinhanha farm.(Family farm from Rio Preto)

Moreover, the *latifundiarios* forced the small-scale farmers with valid titles to sell their land for a trifle. Sometimes the payment was made in goods such as coffee or tobacco. After the small-scale farmer gave up the titles to the *latifundiario,* they were expelled from the land as intruders. This situation is illustrated by a peasant of Santa Rita.

"My father- in- law sold our family land in Santa Rita to Luciano. Luciano never came here. Claudio from Januaria made the land transactions for them. He paid my father in law with packages of tobacco and package of coffee. He did not pay in cash. He sold the land and stayed without anything. After this we were expelled from our land by the police they destroyed our house and our plantations. "(Peasant from Santa Rita)

Another form of land tenure usual in the region is occupancy by people with documents from 100 years ago, that in law justifies rights to the land. Therefore, all land title documents of people that occupy the land are cancelled. This situation has caused enormous violence in the settlements because the landowners give weapons to their employers and contract *jagunços* to defend the land that they occupy without valid titles.

The creation of the National Park stabilised this kind of land tenure in the land because IBAMA just compensate land with genuine and valid titles. At the moment 102 families with farms, small-holders and squatters occupy land inside the National Park. In areas such as Galdino and Rio Preto with intense pressure on tenure caused by the history of land possession, the small-holders think that the National Park stabilised the land conflicts in the region and brought a measure of peace for the local population. This is evidenced by the following quote:-

If IBAMA do not take possession of Luciano farm, I think that there would few people here(Family producer from Rio Preto)

*"The Park is very good because it brought peace for us"(*Small holder from Galdino)

The establishment of the National Park in the region causes another form of land tenure. It occurs because IBAMA purchased less than 10% of the lands necessary for the creation of the Park.

The land inside the National Park is a mosaic of *latifundios*, small farms and squatters. The smallholders and squatters have areas between 25 and 50 hectares, the

Plate 7.1 Area of Shifting cultivation inside the National Park of Grande Sertão Veredas

Plate 7.2 Sun set in the National Park of Grande Sertão Veredas

Plate 7.3 Co-operative in Chapada Gaúcha

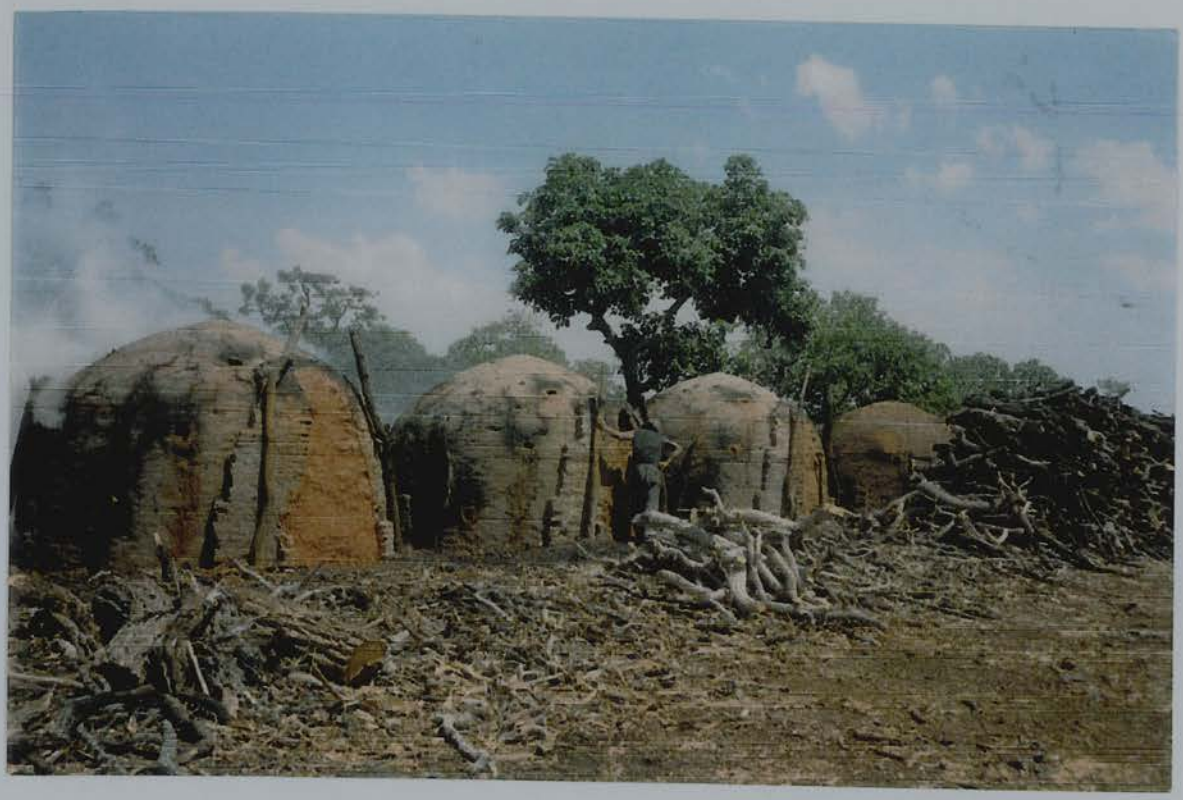

Plate 7.4 Charcoal production around the National Park of Grande Sertão Veredas

Plate 7.5 Folia de Reis inside the National Park of Grande Sertão Veredas

Plate 7.6 View of in the National Park of Grande Sertão Veredas

farms have areas around 200 ha and the *latifundios* have areas of thousands of hectares. The land was used for cattle raising and charcoal production, with the farms have areas around 200 ha and the *latifundios* have areas of thousands of hectares. The land was used for cattle raising and charcoal production, but with the arrival of *gaúchos* in the region the land use has changed to intensive agriculture with Soya, rice and corn production.

An older occupier of *Gerais* thinks that the National Park took away their land and that they do not have another place to settle in the region. This is stressed in his comment :-

*I did not find the creation of this Park good, we are used to living here so to go to another place we find difficult. I am old and I find it difficult to adapt in another place. When the economic compensation came we have to leave (*Peasant from Barbatimão)

There are also farmers who complain about the level of compensation for land with valid titles. They expect to receive economic compensation before they leave their lands:-

The IBAMA do not pay for my land, I do not want to fight for my land because they are located in inferior areas of the Park, but my land is all legalised I have valid documents. I think I have 2000 ha. I just want the value of the legalised land... "
(Rural producer with medium level of income from Batista)

The prices paid by IBAMA are considered low for some farmers. Thus, some of them complain that land for the establishment of the National Park should be very well compensated to permit them to re-establish in other areas of the region.

"If we had conditions to produce in other areas it would, be very good. The

government has to help. The land should be very well paid for the farmers to have conditions to buy land in other place."(Rural Producer from Batista)

The National Park is located on the borders of the Municipality of Chapada Gaúcha. Chapada Gaúcha is located on a plateau and a major problem is the absence of water. Some farms are located on the borders of the Park close to the sources of rivers and *veredas* with the creation of the National Park these areas can not be utilised.

After the creation of the Park a farmer from Chapada Gaúcha was forbidden to plant using his central pivot (for water) and pesticides. Hence, this farmer stopped his production. IBAMA made a proposal to buy the land but he did not accept because the offer did not cover the pivot price. IBAMA representatives told him to take the pivot, but he refused because the pivot was damaged after seven years without maintenance. This pivot was financed by Banco do Brasil (Bank of Brazil) and this farmer became in breach of contract with Banco do Brasil who threaten to take the other area for the pivot payment. Thus this farmer that was considered prosperous, became impoverished and works in another area and as an employee for other farmers in Chapada Gaúcha. He became a symbol of the land tenure caused by the Park in the region. Here this farmer explain his situation in the following comment:-

IBAMA made a survey of the land and deposited some money in the bank; the money did not pay half the price of the land improvements. We were the biggest producers in Chapada Gaúcha because we had the *central pivot, but they prohibited us from using pesticides and we stopped planting. Now we plant in dry areas of the region and work as employees for the other farmers (* Family farmer).

The others farmers of Chapada Gaúcha who had land expropriated also complain about land expropriation because most of these lands are located on the

bank of rivers and these farmers had plans to produce with an irrigation system.

They expropriated my 4 ha that I was thinking of using by installing a pivot, but after the creation of the National Park I gave up(Rural producer with high level of income)

I also was thinking about of using a pivot but 400 ha of my land had been expropriated.(Rural producer with level of income from Chapada Gaúcha).

The *latifundiarios* of the region had extended the limits of their *latifundios* illegally using violence against peasants, squatters and other large farmers. However, some of these *latifundiarios* do not have valid documents for all the land that they occupy.

At the moment IBAMA is studying the possibility of solving the land tenure difficulties of two *latifundios* inside of the Park. The first project was made for the owners of Carinhanha farm. This proposal aims to exchange approximately 18000 ha of land inside of the Park for debts of tax with INSS (National Institute of Social Security). This proposal has been carefully analysed by technicians of IBAMA and INSS because it is the first time in Brazil that land for a National Park has been involved in this type of transaction. The second project is an exchange of approximately 27000 ha of Luciano's farm to be exchanged for another area of *cerrados* outside of the Park to charcoal exploitation.

Thus, these two projects together cover an area of approximately 45000 ha (around 50% of Park area) and regulate the situation of the largest *latifundios* inside the National Park. Additionally, these projects also reduce the number of cattle inside the National Park, because Carinhanha farm still rents the pastures to other farmers.

However, some of peasants, squatters and smallholders that traditionally

occupy the adjacent land of *latifundios*, do not have valid titles for their land and will not be economically compensated by IBAMA and will have to leave their land since their traditional livelihood will be considered an illegal use of natural resources.

7.3 Use of Fire

The use of fire is another significant element in this analysis of socio-economic impact on the National Park of Grande Sertão Veredas.

From the different uses of fire in the region the main components are arson, and burning to clear pastures or fires to prepare areas for shift cultivation.

As illustrated in National Park of Caparaó, arson occurs as revenge against the expropriated land and the lack of compensation by IBAMA. Usually, arson starts on the borders outside the Park. The arsonists use fire at the beginning of the dry season and the fire burns many hectares of *cerrado* every year. The aim of setting light to the vegetation is to damage lands protected by the National Park.

"Last year there were days of fire. People said that I was the arsonist, but the fire came from outside of the Park. IBAMA representatives do not permit us to open roads with tools to avoid fires. This fire burnt all pastures, burnt everything. There was a night that I did not sleep because I was afraid of fire. The fire was the height of the trees. IBAMA did not help to extinguish this fire." Peasant from Onça

From Serra das Araras (Araras mountains) what we can see of the Park is just fire. I think that is arson against the Park (teacher of primary school in Carinhanha)

The fires, which enlarge areas of new pastures, occur at the end of dry season in August-September. The rural producers wait until the rainy season in October

November (when the natives pastures are growing) to establish new areas of grazing.

As in other regions of Brazil, the farmers use fire to clear pastures of unwanted weeds. They also burn the native vegetation at the end of dry season in August - September. At the beginning of the rainy season the pastures grow new vegetation. On average these fires occur every 2 years. The small-scale farmers believe that the cattle need pasture sprouts to grow. It can be observed in the following quote:-

"I use to set a fire because the cattle need to eat the pastures sprouts. If the cattle do not eat the sprouts the cattle become sick" Peasant from Onça

The peasants are very scared of fire because their house can burn. The roofs of their houses are very vulnerable to fire because they are covered with dry palm tree leaves.

"Sometimes we set a fire in an small area, but we are afraid of burn too much. Because fire is a very dangerous if you try to extinguish, you can die" Peasant from Santa Rita

Fires to clear areas for subsistence crops occur every year. The traditional population use fire every year to clean the land in the months of August and September, in a system of slash and burn they use the ashes as fertiliser on plantations in the rainy season in November and December:-

"We put fire to prepare the land to plant. The ashes are fertilisers for the soil. If we do not set a fire we cannot produce" Peasant from Onça

Fires are common where the National Park is located due to traditional land

use practices in the region. Arson is evidence of the difficult relationship between IBAMA and farmers in the Park.

The majority of rural producers of Chapada Gaúcha do not utilise fire in their production. The economic conditions of these farmers and access to the extension service of the co-operative promote the use of other techniques to these farmers. The co-operative extension service recommends herbicides and mechanisation instead of fire.

The majority of fires that occur in the Park are for clearance of new areas or cleaning of pastures. These fires occur every year because the socio-economic conditions of peasants, squatters and smallholders who live inside of the Park make fire the only technique economically possible for them to make a living.

7.5 Benefits

A national Park always creates expectations in the areas where they are established. However, the rural producers from Chapada Gaúcha who were interviewed consider that few benefits can be expected as a result of the Park creation.

For me IBAMA and FUNATURA are lavish with public money(Rural producer with high levels of income from Chapada Gaúcha)

The only benefit that the rural producers expect is a road linking Arinos to São Francisco. It is being demanded by farmers and politicians because of the bad road conditions for transporting agricultural produce to Brasília or Belo Horizonte.

We expect that after this something good will come. Until now we just have problems . I do not want to say that I am against the National Park. Is possible that a National Park will bring something positive to the municipality in the future. I expect that we receive more tax than other municipalities in São Paulo and Parana to balance this situation, because we have lost a large productive area in the municipality.(Mayor of Formoso)

Another important point in this analysis is that FUNATURA contracts the rangers from the traditional population living in the National Park. For this population the Park is the source of work in the region:-

"The National Park brought jobs for us"

Squatter and Ranger in the National Park

However, last year IBAMA and FUNATURA decided that the rangers could not keep livestock inside the National Park. This decision creates a conflict between the rangers and IBAMA and FUNATURA because livestock represent a complementary diet for the rangers' families. In addition the livestock provides their reserve capital for times of uncertainty such as disease in the family and for religious parties such as *Folias de Reis*. Moreover, the rangers are related to most of the residents in the Park and they do not report them to the IBAMA representatives in Chapada Gaúcha .

Another point of conflict is that the majority of the rangers are illiterate and IBAMA representatives think that it is very difficult to train them in environmental law and environmental conservation.

The main benefit that the population expect from the National Park is the

development of the region. A small number of people of the traditional population, who worked for the *latifundios* as cowboys before the establishment of the Park now work in the Park as rangers. For these rangers the Park and FUNATURA are benefits. However the majority of the population do not consider the Park as a benefit because it promotes what they perceive as the disintegration of traditional social relationships in the region.

A new project of FUNATURA now attempts to work on a social basis and integrate development and conservation. The evolution of this program in the future could bring some benefit for the rural communities.

7.4 Environmental Protection

The traditional population that lives around and inside the Park does not have concerns about environment conservation. For this population, survival is the main concern. The people have a traditional knowledge about the environment that can be observed in their daily activities.

"*We cannot put fire in new areas, we can not deforest, the family is growing, the soil is good, we need to grow new areas because the family is growing* "(Peasant from Batista)

On the other hand the population of Chapada Gaúcha do have concerns about environment conservation. The extension service of the co-operative and the better economic conditions of these rural producers (of different categories) make environmental conservation a very important issue. This can be observed in local opinions:

*"I am in accordance with the National Park, this is the heart of Brazil, This is health for us , this is a reserve where we have birds, snakes, this is health"(*Rural producer with a high level of income)

" Reduce the burning and there is more nitrogen; avoiding burning increases the quantity of rain"(Family farmer)

The rural producers of Chapada Gaúcha are also concerned about faunal conservation in the region. They think that for this the National Park is very important.

"Before there were more animals. The people now leave the animals to live" (Rural producer with medium level of income)

"We see many animals, if there is no National Park the people will finish with everything, but still there are people that hunt" Rural producer with high levels of income

A programme of environmental education of FUNATURA has been offered since 1993 to local people that live inside the National Park. However this program does not achieve its objectives due to the lack of knowledge of social reality. Hence FUNATURA decided last year to restructure this programme starting with a complete socio-economic survey of the local population. In addition a program of health and social benefits for the local people had been carried out since 1997 by FUNATURA.

Thus, as can be observed, environmental concerns are linked to economic conditions. The traditional population have sufficient knowledge about the environment but economic conditions do not allow them to use the natural resources in the best way.

The farmers of Chapada Gaúcha were helped by extension service of co-operative to solve their environmental concerns and their economic conditions allow

them to use techniques of soil and water conservation to reduce the environment impact of the type of productive system that they adopt. These farms adopt a type of agriculture with high impact and the majority of them have several problems such as erosion, and contamination with pesticides on their farms that will make their production impracticable over a period of time.

7. 5 Discussion

The social scenario of the region where the National park of Grande SertãoVeredas is located is similar to the scenario of many regions of Brazil where the use of violence by *latifundiarios* against peasants is a constant threat to the survival of the various small-scale farmers. The situation is in a similar context to that which starts peasant movements of resistance, peasants leagues and landless movements as described in chapter one. Through this description it is possible to understand the perennial fight for land in Brazil.

For the traditional population the land tenure created by the establishment of the national Park is just another type of non-violent land tenure. Therefore the traditional population is resigned to their destination because the latifundios always was a threat to their survival.

IBAMA is studying projects to solve the problems of land tenure of the largest *latifundios* inside the Park without having to pay compensation. Such as agreement would favour agro-industrial enterprise with high levels of income and a *latifundio.* However, some farmers who live on the borders of these areas do not have valid titles and there are no concrete proposals to solve the situation of these farmers. Thus there are two major groups involved in the land tenure problem the

latifundiarios who appear to be gaining concession and the small- holders who, as always, seem to be losing their cause.

In spite of involvement in the creation and management of the Park, FUNATURA is not concerned with the solution of land tenure for local people because Brazilian legislation does not allow people to make a living inside a National Park, and also because FUNATURA is ideologically and economically linked to American Nature Conservancy which promotes the American model of management of National Parks and a policy against residence in protected areas.

The traditional communities inside the National Park are very poor and isolated and there is no movement to organise or represent then. Additionally, most of the villages are divided in different municipalities of Formoso and Chapada Gaúcha and few local politicians are concerned about their future.

In areas where the economy is based on primary activities and sources of subsistence, local people cannot be excluded from resources within previous exploited areas. Instead, protected areas must be managed to benefit local people as well as wildlife (STEINBERG, 1993). A national Park by definition should preserve the cultural heritage and all traditional land use. Thus, self sufficient communities such as Barbatimão and Onça are threatened with losing their cultural identity and will be fragmented by Park pressure.

The rural producers from Chapada Gaúcha who had land expropriated and who have not been economically compensated have valid documents and expect to receive compensation for their land. In addition, except the farmer that had the central pivot inside of the Park, the others producers from Chapada Gaúcha have had to wait a long time for compensation. Moreover the lands of these producers that

have been expropriated are not located in their main productive area and the Park does not make their production impracticable.

Fires have occurred in different regions of Brazil for many centuries in order to clear pastures and for shifting cultivation. Arson also occurs in the region but it is difficult to distinguish from natural fires. Arson inside the Park is a consequence of land tenure difficulties created by the establishment of this protected area.

At the moment, the fire is tolerated in areas that have not been compensated inside the Park and there are no fines for fire or arson inside the Park. Last year IBAMA and FUNATURA representatives tried to establish a programme to control the fires. However, this programme has been successful only in Vereda Santa Rita.

The use of fire could be abolished with financial support for adoption of other techniques such as cattle feed and fertilisers for small-scale farmers. Thus conservation and development could be part of the FUNATURA project to combat fire inside the National Park. However, these key issues were not integrated in the FUNATURA project of co-operation in the management of the National Park.

As was evidenced in the previous section, fire is not used by farmers with medium and high levels of income in the region because most of their land is assisted by the rural extension service from the co-operative in Chapada Gaúcha that suggests the use of other techniques as a to substitute for the use of fire. The better conditions of these farmers allow them to observe and use these modern techniques on their properties as a fire substitute.

The possible benefits that the communities expect for the region is a road linking Arinos (Brasília) to São Francisco (Belo Horizonte) to transport the agricultural produce.

Another type of benefit that local politicians consider important is tax available to the municipalities in the Park who have lost productive areas because of environmental conservation.

The program of FUNATURA in 1997 incorporated new characteristics that are a benefit for the traditional population. The National Park is located in a region where several people have leprosy and lack any kind of treatment. Last year FUNATURA contracted a nurse to take patients with leprosy and other diseases to São Francisco for medical treatment. The nurse also helps people of retirement age to take documents to get retirement pensions as rural workers.

The rural producers with high levels of income consider the National Park as a benefit to protect the local environment, especially the sources of rivers since water is a scare commodity in the region. However, the farmers involved in the land tenure created by the establishment of the Park expect to receive compensation that will allow them to buy the same area of land in other areas of the region.

The traditional population has occupied these areas since colonial times living in the gaps of latifundios and making a livelihood from the use of natural resources. COLCHESTER (1994), noted that National Parks established in native lands have denied locals rights to resources turning local people from hunters and cultivators to poachers and squatters.

In the National Park of Grande Sertão Veredas the traditional population know how to maximise the use of natural resources. A good example is buriti palm tree *Mauritea flexuosa* that is used as a cover for most of the roofs and raw material for handcraft inside of the Park. The native population uses this tree without destroying them, so permitting their regeneration.

Most of the economic value of tropical species depends on cumulative local knowledge gained over hundred years of tropical experimentation on tropical species (WOOD, 1995). There is large consumption of medicinal plants in this Park. Some of these plants are cultivated in their gardens together with other vegetables. Moreover, most of the communities have a *benzedor* (sorcerer) who is a recognised authority in the use of local medicinal plant in each area.

Environmental conservation without local people destroys human knowledge of vegetation, prevents experimentation with land uses, removes human disturbances of ecosystems which are essential for biodiversity conservation and stops the historical process which is responsible for the present character of the protected areas(WOOD, 1995). However, these principles are not considered in the programs of environmental education used in Chapada Gaúcha and traditional communities inside the National Park. Additionally, these programmes of environmental education promoted by IBAMA and FUNATURA in the region disseminated the ideas of protection of fauna and flora without human interference, and the environmental knowledge of the local population is not integrated into the programs. Hence, the principles of sustainable use of natural resources that be could jointly developed with conservation around and inside the National Park are not considered.

The rural producers from Chapada Gaúcha who face environmental degradation in their properties have environmental concerns and try to minimise the effects of their agricultural practices on their farms with techniques of soil and water conservation with help from the extension service of the co-operative.

7.6 Summary

The National Park of Grande Sertão Veredas is located in an area of

centennial land tenure problems. The establishment of the National Park proved to be a non violent type of land tenure for the local population.

IBAMA has an agreement of management with FUNATURA. FUNATURA has developed a program of environmental conservation for the local population who live inside the Park and have not been compensated. However this program is based on the American model of management of protected areas and does not use sustainable development to reduce environment degradation.

The rural population of Chapada Gaúcha with high levels of income use techniques of environmental conservation because their type of high environmental impact production demands these techniques and their economic conditions allow them to use these techniques.

In the next chapter the main conclusions derived from this study will be presented.

CHAPTER 8

Conclusions

At the moment there are 9742186 ha of National Parks in Brazil. Most of these Parks face similar problems of land tenure, lack of appropriate management, and lack of programmes which assist the needs of local people. This situation leaves the areas vulnerable to invasion, poaching, deforestation, illegal agriculture, cattle raising, pollution, fires, mining and disorganised tourism.

The basic questions formulated in the introductory chapter show the necessity for a wider understanding of the basic issues of the socio-economic interaction between Park and the adjacent communities. Chapter 3 assessed the problem of parks with high environmental impact. Chapters 4 and 6 determined the land uses and the social stratification in the communities surrounding the National Parks of Caparaó and Grande Sertão Veredas. Finally chapters 5 and 7 discussed the social components of the Parks such as land tenure, use of fire, environmental perceptions, benefits and tourism in these National Park.

The main conclusions derived from this study are:

The pre-existing categories of land tenure and the land tenure created by the National Park are the most significant and difficult element concerning the National Parks in this study. The same situation can be observed in almost all Brazil's National Parks.

The land tenure analysed in this study repeats the historical land tenure in Brazil and impinges on the general Brazilian situation in the conservationist context.

The Brazilian Government has adopted the North American model for the establishment and management of National Parks. Under this system, all land necessary for the establishment of the National Parks is purchased and paid for by the Government when the National Park is established, and the model does not permit permanent residence within the National Park boundaries. This has caused considerable problems in those Parks in Brazil which already had a significant resident population.

The Brazilian legislation does not permit people to make a living inside the National Park areas, neither does it provide the necessary compensation for the displaced population (as in the North American system), thus exacerbating land tenure problems within and around the National Parks areas. There is the additional problem of people being temporarily allowed to continue living in the Park but being unable to make their living by traditional means.

Furthermore, institutional conditions do not encourage the successful management of the National Parks. The political and economical difficulties of the country are reflected in the management of the National Park with IBAMA, having a reduced budget to solve the land tenure problems created in the Parks.

As in other Brazilian National Parks, the land tenure system in Caparaó and Veredas renders many traditional land uses illegal and, as farmers are not economically compensated, they then become enemies to the conservation initiative. This situation can be observed especially in areas where subsistence production is predominant.

The establishment of the National Park Grande Sertão Veredas, as in other National Parks in Brazil, was characterised by lack of public participation. The local population never asked for the creation of the Park area in order to protect the ecosystems of the region and ~~were~~ was therefore never involved in this process. Local residents had little understanding of the concept of a National Park and inadequate effort had been made to involve them in implementation. The ideas for the establishment of National Parks in general are conceived outside the region and IBAMA does not try to involve the local population before the establishment of the protected areas. Consequently, the Parks have become an alien concept threatening the livelihood of local people.

The preliminary socio-economic survey, undertaken by IBAMA for the establishment of the National Parks, is superficial and does not identify the local socio-economic reality. Thus, National Parks are established without knowledge of the degree of socio-economic interface between Park and local communities. This situation spills over into conflicts between Park authorities and local communities and the management of National Parks.

The use of fire is the main ecological problem of the National Parks in Minas Gerais. Every year thousands of hectares of protected areas are destroyed in the state. Fire is the most utilised tool for small-scale farmers around both Parks for economic reasons of preparing and planting and in order to clean pastures. The State and Federal legislation only permits the use of fire for rural producers in special circumstances that do not include protected areas.

However, every year during the months of August / September the farmers set fire to areas of pastures and subsistence plantations. As these National Parks are

located in an area of many small-scale farmers every Park is surrounded by a bonfire of pastures and subsistence plantations.

Sometimes arson occurs and is a reflection of hostility, frustration and the tension provoked by tenure problems around and within the Parks. It is also symptomatic of the lack of dialogue between IBAMA representatives and population in each Park.

Fines and conflicts do not solve the threat of fire to the Parks but have tended to stimulate more arson attacks. Hence, it is necessary to create a specific program of sustainable development for these small-scale farmers to encourage the replacement of burning with techniques which are viable for these farmers.

The establishment of a protected area always creates expectations about direct or indirect benefits for the local communities, especially when this protected area is in a region with a precarious infrastructure, such as these regions where the National Parks in this study are located.

In both Parks the local communities expected roads as a benefit facilitating the transport of agricultural production and to stimulate tourism for the region. However, the construction of these roads was not undertaken.

Perceptions of environmental conservation are important to understand the relationship between man and nature in different social landscapes. The perceptions of environmental conservation by the farmers who live around the National Parks vary according to their position in the social structure.

The rural producers with high levels of income consider environmental preservation important in order to maintain and increase their production in the long term. They also consider the conservation of the rivers and soil of the region

important, and recognise the need to protect ecosystems for future generations. The small-scale farmers have environmental concerns linked to the preservation of natural resources to ensure their survival.

The programmes of environmental conservation and environmental education in the Parks failed to achieve their objectives because they were conceived without previous knowledge of the social reality of each Park and they do not consider the different perceptions of the diverse categories of rural producers in and around each Park as to the use and management of natural resources.

The programme of environmental conservation from FUNATURA should have assisted the traditional populations that live inside the National Park of Grande Sertão Veredas. However, this programme of environmental conservation does not provide the economic means to minimise the environmental impact and at the same time maintain the subsistence level for this population.

In conclusion this research shows that a much better appreciation of the social context of the National Park is needed, and an approach in which local people feel involved and informed about the creation of National Parks.

Therefore, it is essential to have a policy that creates and integrates the National Parks into the local and national socio-economic context, safeguarding traditional land use and integrating it into the cultural and historic heritage of the National Parks.

Thus, it is necessary to have a detailed knowledge of the socio-economic reality of each area. It is also necessary to have economic resources to promote programmes of sustainable development that permit production and environmental conservation in the areas adjacent to the National Parks.

In addition, this research suggests the need for new research into a new model of creation and management of protected areas based on the social, political and economic reality of the country. Only in this way can the conflicts between local people and IBAMA representatives be reduced, and the natural resources of Brazil be effectively protected.

In Summary

1- The adoption of the North American model for National Parks, given Brazil's historical land tenure problems, was ill conceived. This American model introduced in Brazil does not consider the historical background of land occupation of the country, the conditions of land tenure, and increasing social differences in the rural social structure.

2-The long term aim of creating viable National Parks as a means of preserving important ecosystems requires an approach that is not only imposed from the top down institutionally. The institutions need to involve the local population in the process of the establishment of National Parks as a guarantee of its successful creation and management.

3- The social context is the key to the establishment of National Parks especially in Brazil. The National Parks established without consideration of the dynamic social context and the specific regional characteristics of the country tend to face serious conflicts due to the multiplicity of socio-economic factors that can influence their management.

4- This study also suggests that others research about the socio-economic impact of National Parks on their local communities should be developed in other countries, as a foundation for a new model of National Park.

5- A new model which is integrated into the socio-economic and ecological aspects of National Parks needs to be developed. This model should utilise principles of sustainable development thus reducing environmental pressure on the ecosystems and allowing survival of the local population.

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Table 2.9. Environmental impact matrix produced for São José do Barreiro community, National Park of Serra da Canastra.

National Park:	Serra da Canastra								Locality: S. José do Barreiro									
	Human Activities																	
Environmental Components	Cattle raising	Fire	Agriculture	Pesticides	Fertilizers	Hunting	Poaching	Reforesting	Mining	Settlement	Roads	Tourism	Extractivism	Timber	Fisherie	Charcoal	Firewood	TOTALS
Water:																		
Turbidity	1	0	2	0	0	0	0	0	5	0	1	0	0	2	0	0	0	11
Chemical pollution	0	0	0	2	0	0	0	0	5	0	0	0	0	0	0	0	0	7
Silted watercourses	0	0	0	0	0	0	0	0	5	0	1	0	0	1	0	0	0	7
Increased demand	1	1	0	1	0	0	0	3	5	0	0	0	0	0	0	0	0	11
Totals:	2	1	2	3	0	0	0	3	20	0	2	0	0	3	0	0	0	36
Air:																		
Chemical pollution	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dust	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Smoke	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Totals:	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Soils:																		
Erosion	1	0	2	0	0	0	0	0	5	0	1	0	0	1	0	0	1	11
Compacting	2	0	1	0	0	0	0	0	2	0	2	1	0	0	0	0	0	8
Chemical pollution	0	0	0	2	1	0	0	0	5	0	0	0	0	0	0	0	0	8
Nutrient losses	2	0	3	0	0	0	0	3	5	0	1	0	0	2	0	0	2	18
Increased salts	0	0	2	0	3	0	0	0	0	0	0	0	0	0	0	0	0	5
Totals:	5	0	8	2	4	0	0	3	17	0	4	1	0	3	0	0	3	50
Wildlife:																		
Populational decreases	0	2	0	2	0	0	0	0	4	0	2	1	0	0	0	0	0	11
Habitat losses	2	2	2	1	0	0	0	3	4	0	1	0	0	2	0	0	2	19
Habitat alterations	3	3	3	2	3	0	0	3	5	0	2	1	0	3	0	0	2	30
Exotic species	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
Inadequate food supply	2	3	1	2	1	0	0	3	5	0	0	0	0	2	0	0	2	21
Inadequate water supply	0	0	0	2	0	0	0	0	5	0	0	0	0	0	0	0	0	7
Intoxication	0	1	0	2	0	0	0	0	5	0	0	0	0	0	0	0	0	8
Totals:	12	11	6	11	4	0	0	9	28	0	5	2	0	7	0	0	6	101
Vegetation:																		
Populational decreases	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Habitat alterations	3	2	2	2	1	0	0	3	4	0	1	1	0	2	0	0	2	23
Biomass reduction	3	3	3	2	0	0	0	0	4	0	1	1	0	3	0	0	2	22
Vegetation cover reduct	3	3	3	2	0	0	0	0	4	0	1	0	0	3	0	0	2	21
Exotic species	3	0	4	0	3	0	0	3	0	0	0	1	0	0	0	0	0	14
Chemical damage	0	0	0	2	0	0	0	0	5	0	0	0	0	0	0	0	0	7
Totals:	12	8	12	8	4	0	0	6	17	0	3	3	0	8	0	0	6	87
Scenic resources:																		
Geological features	1	1	1	0	2	0	0	1	5	0	1	0	0	2	0	0	0	14
Scenic view	2	3	3	0	0	0	0	2	5	0	1	0	0	1	0	0	0	17
Landscape	3	3	4	0	0	0	0	3	5	0	1	0	0	1	0	0	0	20
Totals:	6	7	8	0	2	0	0	6	15	0	3	0	0	4	0	0	0	51
Culture:																		
Cultural monuments	1	3	1	0	0	0	0	0	0	0	2	2	0	0	0	0	0	9
Cultural buildings	3	3	3	0	0	0	0	0	0	0	0	2	0	3	0	0	1	15
Cultural heritage	5	5	5	4	4	0	0	4	5	0	4	4	0	4	0	0	5	49
Ethnobiological resource	3	3	3	2	2	0	0	2	2	0	2	2	0	2	0	0	2	25
Totals:	12	14	12	6	6	0	0	6	7	0	8	10	0	9	0	0	8	98
Socio-economic resources:																		
Local attitudes	5	5	5	3	3	0	0	3	5	0	4	4	0	4	0	0	5	46
Conflicts	3	3	3	2	1	0	0	2	5	0	1	2	0	3	0	0	2	27
Land uses	4	4	5	4	4	0	0	4	5	0	4	3	0	3	0	0	5	45
Land tenure	3	2	1	0	0	0	0	0	2	0	0	0	0	1	0	0	1	10
Economic resources	5	5	5	5	5	0	0	5	5	0	5	5	0	5	0	0	2	52
Educational programs	5	5	5	5	5	0	0	5	5	0	0	5	0	5	0	0	5	50
Extension programs	5	4	5	5	5	0	0	5	5	0	5	5	0	5	0	0	5	54
Totals:	30	28	29	24	23	0	0	24	32	0	19	24	0	26	0	0	25	284
TOTALS	79	72	77	54	43	0	0	57	136	0	44	40	0	60	0	0	48	710

Table 2.8. Environmental impact matrix produced for São João Batista da Serra da Canastra community, National Park of Serra da Canastra.

National Park:	Serra da Canastra								Locality: S. J. B. da Serra da Canastra									
	Human Activities																	
Environmental Components	Cattle raising	Fire	Agriculture	Pesticides	Fertilizers	Hunting	Poaching	Reforesting	Mining	Settlement	Roads	Tourism	Extractivism	Timber	Fisherie	Charcoal	Firewood	TOTALS
Water:																		
Turbidity	1	0	1	1	1	0	0	0	0	0	1	0	0	1	0	0	1	7
Chemical pollution	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Silted watercourses	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Increased demand	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Totals:	3	0	1	4	1	0	0	0	0	0	1	0	0	1	0	0	1	12
Air:																		
Chemical pollution	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dust	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Smoke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Soils:																		
Erosion	2	0	2	0	0	0	0	0	0	0	1	0	0	1	0	0	1	7
Compacting	3	0	2	0	0	0	0	0	0	0	2	0	0	0	0	0	0	7
Chemical pollution	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Nutrient losses	3	0	3	0	0	0	0	2	0	0	1	0	0	2	0	0	2	13
Increased salts	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
Totals:	8	0	8	1	3	0	0	2	0	0	4	0	0	3	0	0	3	32
Wildlife:																		
Populational decreases	0	2	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	4
Habitat losses	3	3	2	1	0	0	0	2	0	0	1	0	0	1	0	0	1	14
Habitat alterations	3	3	2	2	1	0	0	2	0	0	1	0	0	2	0	0	1	17
Exotic species	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Inadequate food supply	3	3	3	2	0	0	0	2	0	0	1	0	0	2	0	0	1	17
Inadequate water supply	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Intoxication	0	3	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	5
Totals:	13	14	7	9	1	0	0	6	0	0	4	0	0	5	0	0	3	62
Vegetation:																		
Populational decreases	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Habitat alterations	3	2	3	2	1	0	0	2	0	0	1	0	0	1	0	0	0	15
Biomass reduction	3	3	3	2	0	0	0	0	0	0	1	0	0	2	0	0	2	16
Vegetation cover reduct	3	3	3	2	0	0	0	0	0	0	1	0	0	2	0	0	2	16
Exotic species	3	0	5	0	0	0	0	3	0	0	0	0	0	0	0	0	0	11
Chemical damage	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Totals:	12	8	14	8	1	0	0	5	0	0	3	0	0	5	0	0	4	60
Scenic resources:																		
Geological features	2	0	2	0	0	0	0	1	0	0	1	0	0	1	0	0	1	8
Scenic view	3	3	2	0	0	0	0	2	0	0	2	0	0	1	0	0	1	14
Landscape	3	3	3	0	0	0	0	2	0	0	2	0	0	1	0	0	1	15
Totals:	8	6	7	0	0	0	0	5	0	0	5	0	0	3	0	0	3	37
Culture:																		
Cultural monuments	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Cultural buildings	5	3	4	0	0	0	0	0	0	0	0	0	0	3	0	0	0	15
Cultural heritage	5	5	5	3	3	0	0	5	0	0	2	0	0	3	0	0	5	36
Ethnobiological resources	2	2	2	2	0	0	0	2	0	0	1	0	0	1	0	0	2	14
Totals:	13	13	11	5	3	0	0	7	0	0	3	0	0	7	0	0	7	69
Socio-economic resources:																		
Local attitudes	5	5	5	3	3	0	0	3	0	0	3	0	0	3	0	0	5	35
Conflicts	3	5	3	3	0	0	0	0	0	0	5	0	0	4	0	0	3	26
Land uses	5	5	5	5	5	0	0	5	0	0	5	0	0	2	0	0	3	40
Land tenure	3	3	2	2	0	0	0	2	0	0	3	0	0	1	0	0	2	18
Economic resources	5	5	5	5	5	0	0	5	0	0	5	0	0	2	0	0	2	39
Educational programs	5	5	5	5	5	0	0	5	0	0	5	0	0	5	0	0	5	45
Extension programs	5	5	5	5	5	0	0	5	0	0	5	0	0	5	0	0	5	45
Totals:	31	33	30	28	23	0	0	25	0	0	31	0	0	22	0	0	25	248
TOTALS	88	74	78	55	32	0	0	50	0	0	51	0	0	46	0	0	46	520

Table 3.7. Environmental impact matrix produced for São Roque de Minas community, National Park of Serra da Canastra.

National Park:	Serra da Canastra								Locality: Sao Roque de Minas									
	Human Activities																	
Environmental Components	Cattle raising	Fire	Agriculture	Pesticides	Fertilizers	Hunting	Poaching	Reforesting	Mining	Settlement	Roads	Tourism	Extractivism	Timber	Fisherie	Charcoal	Firewood	TOTALS
Water:																		
Turbidity	1	0	1	2	2	0	0	0	0	0	1	0	0	1	0	0	2	10
Chemical pollution	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Silted watercourses	0	0	1	0	2	0	0	0	0	0	1	0	0	0	0	0	0	4
Increased demand	2	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0	5
Totals:	3	0	2	5	4	0	0	2	0	0	2	0	0	1	0	0	2	21
Air:																		
Chemical pollution	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dust	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Smoke	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Totals:	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Soils:																		
Erosion	2	0	2	0	0	0	0	0	0	0	1	1	0	1	0	0	2	9
Compacting	3	0	0	0	0	0	0	0	0	0	3	1	0	0	0	0	0	7
Chemical pollution	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Nutrient losses	3	0	4	0	0	0	0	3	0	0	1	1	0	2	0	0	3	17
Increased salts	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
Totals:	8	0	6	2	3	0	0	3	0	0	5	3	0	3	0	0	5	38
Wildlife:																		
Populational decreases	0	2	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	4
Habitat losses	2	1	2	2	0	0	0	2	0	0	1	0	0	1	0	0	1	12
Habitat alterations	3	2	3	2	3	0	0	3	0	0	1	1	0	1	0	0	1	20
Exotic species	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5
Inadequate food supply	2	2	3	2	0	0	0	3	0	0	0	0	0	1	0	0	2	15
Inadequate water supply	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Intoxication	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Totals:	11	7	8	11	3	0	0	8	0	0	3	1	0	3	0	0	5	60
Vegetation:																		
Populational decreases	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Habitat alterations	2	2	2	2	1	0	0	2	0	0	1	0	0	1	0	0	1	14
Biomass reduction	2	3	3	2	0	0	0	0	0	0	1	0	0	3	0	0	2	16
Vegetation cover reduct	2	3	3	1	0	0	0	0	0	0	1	0	0	3	0	0	2	15
Exotic species	2	0	4	0	0	0	0	3	0	0	0	0	0	0	0	0	0	9
Chemical damage	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Totals:	9	8	12	7	1	0	0	5	0	0	3	0	0	7	0	0	5	57
Scenic resources:																		
Geological features	2	2	3	0	0	0	0	1	0	0	2	1	0	1	0	0	0	12
Scenic view	2	0	2	0	0	0	0	1	0	0	1	0	0	1	0	0	1	8
Landscape	2	0	3	0	0	0	0	1	0	0	1	0	0	1	0	0	0	8
Totals:	6	2	8	0	0	0	0	3	0	0	4	1	0	3	0	0	1	28
Culture:																		
Cultural monuments	0	0	0	0	0	0	0	0	0	0	1	3	0	1	0	0	0	5
Cultural buildings	4	2	4	0	0	0	0	2	0	0	1	1	0	2	0	0	3	19
Cultural heritage	5	5	4	2	2	0	0	2	0	0	4	1	0	2	0	0	4	31
Ethnobiological resource	2	2	2	2	0	0	0	0	0	0	1	0	0	1	0	0	1	11
Totals:	11	9	10	4	2	0	0	4	0	0	7	5	0	6	0	0	8	66
Socio-economic resources:																		
Local attitudes	5	5	4	2	2	0	0	2	0	0	4	4	0	3	0	0	4	35
Conflicts	4	5	3	2	0	0	0	0	0	0	3	3	0	4	0	0	3	27
Land uses	5	5	5	5	5	0	0	3	0	0	5	3	0	4	0	0	3	43
Land tenure	2	3	2	1	0	0	0	0	0	0	0	0	0	2	0	0	0	10
Economic resources	5	5	5	5	5	0	0	0	0	0	5	4	0	4	0	0	5	43
Educational programs	5	5	5	5	5	0	0	5	0	0	5	5	0	5	0	0	5	50
Extension programs	5	5	5	5	5	0	0	5	0	0	5	5	0	5	0	0	5	50
Totals:	31	33	29	25	22	0	0	15	0	0	27	24	0	27	0	0	25	258
TOTALS	79	61	75	54	35	0	0	40	0	0	51	34	0	50	0	0	51	530

Table 3.10. Environmental impact matrix produced for Interna community, National Park of Serra do Cipó.

National Park:	Serra do Cipó										Locality:	Interna					
	Human Activities																
Environmental Components	Cattle raisin	Fire	Agriculture	Pesticides	Fertilizers	Hunting	Poaching	Reforesting	Mining	Settlement	Roads	Tourism	Extractivism	Timber	Fisherie	Charcoal	Firewood	TOTALS
Water:																		
Turbidity	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	3
Chemical pollution	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	4
Silted watercourses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Increased demand	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Totals:	2	0	1	0	0	0	0	0	0	0	1	4	0	0	0	0	0	8
Air:																		
Chemical pollution	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dust	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Smoke	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Totals:	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Soils:																		
Erosion	1	0	2	0	0	0	0	0	0	0	1	0	1	1	0	0	1	7
Compacting	2	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	4
Chemical pollution	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nutrient losses	1	0	2	0	0	0	0	0	0	0	1	0	2	2	0	0	2	10
Increased salts	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals:	4	0	5	0	0	0	0	0	0	0	3	0	3	3	0	0	3	21
Wildlife:																		
Populational decreases	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	3
Habitat losses	1	2	2	0	0	0	0	0	0	0	0	0	1	1	0	0	1	8
Habitat alterations	1	3	3	0	0	0	0	0	0	0	1	0	1	1	0	0	1	11
Exotic species	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Inadequate food supply	2	0	2	0	0	0	0	0	0	0	0	0	2	2	0	0	2	10
Inadequate water supply	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Intoxication	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Totals:	7	9	7	0	0	0	0	0	0	0	2	0	4	4	0	0	4	37
Vegetation:																		
Populational decreases	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Habitat alterations	2	2	2	0	0	0	0	0	0	0	1	0	2	2	0	0	1	12
Biomass reduction	2	2	2	0	0	0	0	0	0	0	0	0	3	3	0	0	2	14
Vegetation cover reduct	2	2	2	0	0	0	0	0	0	0	1	0	2	2	2	0	2	15
Exotic species	2	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
Chemical damage	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals:	9	6	9	0	0	0	0	0	0	0	2	0	7	7	2	0	5	47
Scenic resources:																		
Geological features	1	1	1	0	0	0	0	0	0	0	1	0	1	1	0	0	1	7
Scenic view	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Landscape	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Totals:	3	5	3	0	0	0	0	0	0	0	1	0	1	1	0	0	1	15
Culture:																		
Cultural monuments	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2
Cultural buildings	2	2	2	0	0	0	0	0	0	0	2	0	0	0	0	0	0	8
Cultural heritage	4	4	4	0	0	0	0	0	0	0	4	0	4	4	0	0	4	28
Ethnobiological resource	2	1	4	0	0	0	0	0	0	0	2	0	4	4	0	0	4	21
Totals:	8	8	10	0	0	0	0	0	0	0	9	0	8	8	0	0	8	59
Socio-economic resources:																		
Local attitudes	4	4	5	0	0	0	0	0	0	0	3	4	4	4	0	0	4	32
Conflicts	5	5	5	0	0	0	0	0	0	0	4	4	5	5	0	0	5	38
Land uses	5	4	5	0	0	0	0	0	0	0	3	0	3	4	0	0	5	29
Land tenure	4	5	4	0	0	0	0	0	0	0	2	0	4	4	0	0	4	27
Economic resources	5	5	5	0	0	0	0	0	0	0	3	0	5	5	0	0	5	33
Educational programs	5	5	5	0	0	0	0	0	0	0	5	2	5	5	0	0	5	37
Extension programs	5	5	5	0	0	0	0	0	0	0	5	4	5	5	0	0	5	39
Totals:	33	33	34	0	0	0	0	0	0	0	25	14	31	32	0	0	33	235
TOTALS	66	64	69	0	0	0	0	0	0	0	43	18	54	55	2	0	54	425

Table 3.11. Environmental impact matrix produced for Entrada community, National Park of Serra do Cipó.

National Park:	Serra do Cipó										Locality: Entrada							
	Human Activities																	
Environmental Components	Cattle raisin	Fire	Agriculture	Pesticides	Fertilizers	Hunting	Poaching	Reforesting	Mining	Settlement	Roads	Tourism	Extractivism	Timber	Fisherie	Charcoal	Firewood	TOTALS
Water:																		
Turbidity	1	0	1	0	0	0	0	0	0	0	2	2	2	2	0	0	2	12
Chemical pollution	0	0	1	2	0	0	0	0	0	0	0	1	0	0	0	0	0	4
Silted watercourses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Increased demand	1	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	4
Totals:	2	0	3	3	0	0	0	0	0	0	2	4	2	2	0	0	2	20
Air:																		
Chemical pollution	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dust	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Smoke	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Totals:	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Soils:																		
Erosion	1	0	2	0	0	0	0	0	0	0	2	1	2	2	0	0	2	12
Compacting	2	0	1	0	0	0	0	0	0	0	3	2	0	0	0	0	0	8
Chemical pollution	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Nutrient losses	1	0	2	0	0	0	0	0	0	0	0	0	2	2	0	0	2	9
Increased salts	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
Totals:	4	0	5	2	3	0	0	0	0	0	5	3	4	4	0	0	4	34
Wildlife:																		
Populational decreases	0	1	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	4
Habitat losses	1	2	2	0	1	0	0	0	0	0	1	1	1	2	0	0	2	13
Habitat alterations	2	3	3	1	2	0	0	0	0	0	2	2	2	2	0	0	2	21
Exotic species	3	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	4
Inadequate food supply	3	2	2	1	2	0	0	0	0	0	1	0	3	2	0	0	2	18
Inadequate water supply	0	1	0	3	0	0	0	0	0	0	0	0	2	0	0	0	0	6
Intoxication	0	2	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	5
Totals:	9	11	7	9	5	0	0	0	0	0	4	4	9	7	0	0	6	71
Vegetation:																		
Populational decreases	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	2
Habitat alterations	2	2	2	1	1	0	0	0	0	0	0	2	2	2	0	0	2	16
Biomass reduction	3	3	3	2	2	0	0	0	0	0	1	1	3	2	0	0	2	22
Vegetation cover reduct	3	3	3	2	0	0	0	0	0	0	1	2	2	2	0	0	2	20
Exotic species	3	0	3	0	0	0	0	0	0	0	0	3	0	0	0	0	0	9
Chemical damage	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Totals:	11	8	11	6	3	0	0	0	0	0	2	8	8	7	0	0	6	70
Scenic resources:																		
Geological features	2	2	1	1	0	0	0	0	0	0	1	2	1	1	0	0	1	12
Scenic view	1	1	2	1	0	0	0	0	0	0	1	2	1	1	0	0	1	11
Landscape	1	1	2	1	0	0	0	0	0	0	1	2	1	1	0	0	1	11
Totals:	4	4	5	3	0	0	0	0	0	0	3	6	3	3	0	0	3	34
Culture:																		
Cultural monuments	1	2	1	3	0	0	0	0	0	0	0	3	0	0	0	0	0	10
Cultural buildings	2	2	3	5	0	0	0	0	0	0	0	2	0	0	0	0	0	14
Cultural heritage	2	3	5	0	2	2	0	0	0	0	2	2	3	3	0	0	3	27
Ethnobiological resource	1	2	3	0	1	2	0	0	0	0	1	2	3	3	0	0	3	21
Totals:	6	9	12	8	3	4	0	0	0	0	3	9	6	6	0	0	6	72
Socio-economic resources:																		
Local attitudes	3	4	5	4	4	0	0	0	0	0	3	4	2	3	0	0	3	35
Conflicts	4	5	3	4	2	0	0	0	0	0	3	2	4	5	0	0	4	36
Land uses	4	3	5	4	4	0	0	0	0	0	3	2	2	2	0	0	2	31
Land tenure	2	2	2	2	2	0	0	0	0	0	1	1	4	2	0	0	2	20
Economic resources	4	4	4	5	4	0	0	0	0	0	3	4	4	4	0	0	4	40
Educational programs	4	5	4	5	5	0	0	0	0	0	2	5	4	4	0	0	5	43
Extension programs	5	5	5	5	5	0	0	0	0	0	2	5	5	5	0	0	5	47
Totals:	26	28	28	29	26	0	0	0	0	0	17	23	25	25	0	0	25	252
TOTALS	62	63	71	60	40	4	0	0	0	0	36	57	57	54	0	0	52	556

Table 3.12. Environmental impact matrix produced for Complexo Turístico community, National Park of Serra do Cipó.

National Park:	Serra do Cipó					Locality: Complexo Turístico												
	Human Activities																	
Environmental Components	Cattle raisin	Fire	Agriculture	Pesticides	Fertilizers	Hunting	Poaching	Reforesting	Mining	Settlement	Roads	Tourism	Extractivism	Timber	Fisherie	Charcoal	Firewood	TOTALS
Water:																		
Turbidity	0	1	0	0	0	0	0	0	0	0	1	2	1	0	0	0	0	5
Chemical pollution	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	4
Silted watercourses	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Increased demand	1	0	1	0	0	0	0	0	0	0	0	4	0	0	0	0	0	6
Totals:	1	1	2	0	0	0	0	0	0	0	1	8	3	0	0	0	0	16
Air:																		
Chemical pollution	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dust	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Smoke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Soils:																		
Erosion	1	0	2	0	0	0	0	0	0	0	1	2	1	1	0	0	0	8
Compacting	2	1	1	0	0	0	0	0	0	0	2	3	0	0	0	0	0	9
Chemical pollution	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Nutrient losses	2	0	3	0	0	0	0	0	0	0	1	1	1	1	0	0	0	9
Increased salts	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
Totals:	5	1	6	1	2	0	0	0	0	0	4	6	2	2	0	0	0	29
Wildlife:																		
Populational decreases	0	2	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	4
Habitat losses	1	2	1	2	0	0	0	0	0	0	0	2	1	1	0	0	0	10
Habitat alterations	2	2	2	2	0	0	0	0	0	0	2	3	2	2	0	0	1	18
Exotic species	3	0	0	0	0	0	0	0	0	0	0	3	1	0	0	0	1	8
Inadequate food supply	2	2	1	1	0	0	0	0	0	0	0	2	1	1	0	0	1	11
Inadequate water supply	0	0	0	1	0	0	0	0	0	0	0	3	0	0	0	0	0	4
Intoxication	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Totals:	8	8	4	8	0	0	0	0	0	0	3	13	5	4	0	0	3	56
Vegetation:																		
Populational decreases	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Habitat alterations	2	2	2	1	0	2	0	0	0	0	1	2	1	2	0	0	1	16
Biomass reduction	2	2	2	1	0	0	0	0	0	0	1	3	1	2	0	0	2	16
Vegetation cover reduct	2	2	2	1	0	0	0	0	0	0	1	3	1	2	0	0	1	15
Exotic species	2	0	3	1	0	0	0	0	0	0	0	5	1	2	0	0	2	16
Chemical damage	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Totals:	8	6	9	5	0	2	0	0	0	0	3	13	4	8	0	0	6	64
Scenic resources:																		
Geological features	2	3	1	0	0	0	0	0	0	0	1	2	1	1	0		1	12
Scenic view	1	2	1	0	0	0	0		0	0	2	2	1	2	0	0	1	12
Landscape	1	2	1	0	0	0	0	0	0	0	2	3	2	2	0	0	1	14
Totals:	4	7	3	0	0	0	0	0	0	0	5	7	4	5	0	0	3	38
Culture:																		
Cultural monuments	0	2	0	0	0	0	0	0	0	0	1	5	0	2	0	0	0	10
Cultural buildings	0	3	2	0	2	2	0	0	0	0	2	5	0	2	0	0	2	20
Cultural heritage	3	3	3	0	0	0	0	0	0	0	3	5	2	2	0	0	2	23
Ethnobiological resource	2	2	2		0	0	0	0	0	0	2	5	2	3	0	0	3	21
Totals:	5	10	7	0	2	2	0	0	0	0	8	20	4	9	0	0	7	74
Socio-economic resources:																		
Local attitudes	2	4	3	5	3	0	0	0	0	0	4	5	2	3	0	0	3	34
Conflicts	2	4	2	4	2	0	0	0	0	0	2	3	2	3	0	0	3	27
Land uses	3	3	3	3	3	0	0	0	0	0	3	4	2	3	0	0	3	30
Land tenure	2	2	2	2	3	0	0	0	0	0	1	3	2	2	0	0	3	22
Economic resources	3	3	3	4	5	0	0	0	0	0	3	5	4	2	0	0	2	34
Educational programs	3	5	4	5	5	0	0	0	0	0	3	5	4	4	0	0	4	42
Extension programs	5	5	5	5	5	0	0	0	0	0	4	5	4	4	0	0	5	47
Totals:	20	26	22	28	26	0	0	0	0	0	20	30	20	21	0	0	23	236
TOTALS	51	59	53	42	30	4	0	0	0	0	44	97	42	49	0	0	42	513

Table 3.13. Environmental impact matrix produced for Alto Caparaó community, National Park of Caparaó.

National Park:	Caparaó								Locality: Alto Caparaó									
	Human Activities																	
Environmental Components	Co	Fir	Ag	Pe	Fe	Hu	Pc	Re	Mi	Se	Ra	To	Ex	Tin	Fis	Ct	Fir	TO
Water:																		
Turbidity	1	0	1	1	1	0	0	0	0	0	0	1	0	0	0	0	0	5
Chemical pollution	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Silted watercourses	0	0	1	1	0	0	0	1	0	0	1	1	0	0	0	0	0	5
Increased demand	2	0	0	0	1	0	0	2	0	0	0	3	0	0	0	0	0	8
Totals:	3	0	2	2	2	0	0	3	0	0	1	6	0	0	0	0	0	19
Air:																		
Chemical pollution	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dust	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Smoke	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Totals:	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Soils:																		
Erosion	1	0	3	0	0	0	0	1	0	0	1	1	0	1	0	0	1	9
Compacting	3	0	2	0	0	0	0	0	0	0	2	2	0	0	0	0	0	9
Chemical pollution	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Nutrient losses	3	0	4	0	0	0	0	3	0	0	1	2	0	2	0	0	2	17
Increased salts	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	4
Totals:	7	0	9	2	4	0	0	4	0	0	4	5	0	3	0	0	3	41
Wildlife:																		
Populational decreases	0	2	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	4
Habitat losses	2	3	2	0	1	0	0	2	0	0	1	1	0	1	0	0	1	14
Habitat alterations	3	4	3	2	3	0	0	3	0	0	2	2	0	1	0	0	2	25
Exotic species	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
Inadequate food supply	3	4	4	1	1	0	0	2	0	0	1	0	0	1	0	0	0	17
Inadequate water supply	1	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
Intoxication	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Totals:	14	18	10	6	5	0	0	7	0	0	5	3	0	3	0	0	3	74
Vegetation:																		
Populational decreases	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Habitat alterations	2	3	4	2	4	0	0	2	0	0	1	1	0	1	0	0	1	21
Biomass reduction	3	4	3	3	0	0	0	1	0	0	1	1	0	2	0	0	2	20
Vegetation cover reduct	4	4	4	3	0	0	0	1	0	0	1	2	0	1	0	0	1	21
Exotic species	4	0	5	0	0	0	0	4	0	0	0	3	0	0	0	0	0	16
Chemical damage	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Totals:	13	13	16	10	4	0	0	8	0	0	3	7	0	4	0	0	4	82
Scenic resources:																		
Geological features	0	2	3	1	1	0	0	1	0	0	1	1	0	1	0	0	1	12
Scenic view	3	2	3	1	1	0	0	1	0	0	1	2	0	1	0	0	1	16
Landscape	3	2	3	1	1	0	0	2	0	0	2	1	0	1	0	0	1	17
Totals:	6	6	9	3	3	0	0	4	0	0	4	4	0	3	0	0	3	45
Culture:																		
Cultural monuments	3	4	3	0	1	0	0	2	0	0	2	4	0	4	0	0	2	25
Cultural buildings	3	4	5	0	5	0	0	3	0	0	2	5	0	3	0	0	1	31
Cultural heritage	4	5	5	5	5	0	0	3	0	0	4	5	0	5	0	0	5	46
Ethnobiological resources	2	2	2	2	2	0	0	0	0	0	1	2	0	1	0	0	2	16
Totals:	12	15	15	7	13	0	0	8	0	0	9	16	0	13	0	0	10	118
Socio-economic resources:																		
Local attitudes	4	5	5	5	5	0	0	3	0	0	5	5	0	3	0	0	3	43
Conflicts	4	5	3	3	2	0	0	2	0	0	2	4	0	2	0	0	3	30
Land uses	5	4	5	5	5	0	0	3	0	0	5	4	0	3	0	0	3	42
Land tenure	5	5	5	1	3	0	0	1	0	0	3	2	0	3	0	0	2	30
Economic resources	4	5	5	5	5	0	0	3	0	0	5	5	0	3	0	0	5	45
Educational programs	5	5	5	5	5	0	0	5	0	0	5	5	0	5	0	0	5	50
Extension programs	5	5	5	5	5	0	0	5	0	0	5	5	0	5	0	0	5	50
Totals:	32	34	33	29	30	0	0	22	0	0	30	30	0	24	0	0	26	290
TOTALS	87	89	94	59	61	0	0	56	0	0	56	71	0	50	0	0	49	672

Table 3.14. Environmental impact matrix produced for Santa Marta community, National Park of Caparaó.

National Park:	Caparaó								Locality: Santa Marta									
	Human Activities																	
Environmental Components	Cattle raisin	Fire	Agriculture	Pesticides	Fertilizers	Hunting	Poaching	Reforesting	Mining	Settlement	Roads	Tourism	Extractivism	Timber	Fisherie	Charcoal	Firewood	TOTALS
Water:																		
Turbidity	1	0	1	1	0	0	0	2	1	0	1	0	2	1	2	0	1	13
Chemical pollution	0	0	1	2	0	0	0	2	0	0	0	0	0	0	3	0	0	8
Silted watercourses	0	0	0	0	0	0	0	1	2	0	1	0	2	1	3	0	1	11
Increased demand	1	0	0	0	1	0	0	4	0	0	0	1	0	0	5	0	0	12
Totals:	2	0	2	3	1	0	0	9	3	0	2	1	4	2	13	0	2	44
Air:																		
Chemical pollution	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dust	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Smoke	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Totals:	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Soils:																		
Erosion	1	0	2	0	0	0	0	3	3	0	2	1	2	2	3	0	1	20
Compacting	2	0	2	0	0	0	0	2	0	0	2	0	0	1	2	0	0	11
Chemical pollution	0	0	3	2	0	0	0	1	0	0	0	0	0	0	0	0	0	6
Nutrient losses	2	0	5	0	0	0	0	3	0	0	2	0	3	3	2	0	2	22
Increased salts	0	0	0	0	4	0	0	3	0	0	0	0	0	0	0	0	0	7
Totals:	5	0	12	2	4	0	0	12	3	0	6	1	5	6	7	0	3	66
Wildlife:																		
Populational decreases	0	2	0	0	0	0	4	0	0	0	1	0	0	0	2	0	0	9
Habitat losses	2	3	2	1	0	0	0	2	1	0	1	1	2	1	2	0	1	19
Habitat alterations	3	4	4	2	3	0	0	3	2	0	2	1	3	2	2	0	1	32
Exotic species	4	0	3	0	0	0	0	0	0	0	0	0	0	0	5	0	0	12
Inadequate food supply	2	4	3	2	0	0	0	3	0	0	1	0	3	1	2	0	1	22
Inadequate water supply	0	0	0	1	0	0	0	0	0	0	0	0	0	0	3	0	0	4
Intoxication	0	3	0	2	0	0	0	1	0	0	0	0	0	0	2	0	0	8
Totals:	11	16	12	8	3	0	4	9	3	0	5	2	8	4	18	0	3	106
Vegetation:																		
Populational decreases	0	0	0	3	0	0	0	0	0	0	0	0	2	0	0	0	0	5
Habitat alterations	3	2	3	2	2	0	0	4	3	0	1	0	3	2	3	0	2	30
Biomass reduction	4	3	3	2	0	0	0	1	2	0	1	0	3	2	3	0	2	26
Vegetation cover reduct	4	3	2	2	0	0	0	1	2	0	1	0	3	3	2	0	2	25
Exotic species	4	0	2	0	2	0	0	5	0	0	0	0	0	0	2	0	3	18
Chemical damage	5	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	1	9
Totals:	20	8	11	10	4	0	0	12	7	0	3	0	11	7	10	0	10	113
Scenic resources:																		
Geological features	2	1	2	1	1	0	0	2	5	0	2	0	2	2	3	0	2	25
Scenic view	1	2	2	1	1	0	0	1	2	0	1	0	2	1	2	0	1	17
Landscape	2	1	2	1	1	0	0	2	2	0	1	0	2	2	3	0	1	20
Totals:	5	4	6	3	3	0	0	5	9	0	4	0	6	5	8	0	4	62
Culture:																		
Cultural monuments	2	2	1	0	0	0	0	1	0	0	1	0	3	1	4	0	1	16
Cultural buildings	2	3	3	0	3	0	0	2	0	0	1	0	5	2	2	0	1	24
Cultural heritage	3	4	5	3	5	0	4	5	3	0	4	5	5	4	4	0	4	58
Ethnobiological resource	2	2	2	1	0	0	3	2	1	0	1	3	3	2	0	0	2	24
Totals:	9	11	11	4	8	0	7	10	4	0	7	8	16	9	10	0	8	122
Socio-economic resources:																		
Local attitudes	3	5	5	5	5	0	5	5	4	0	5	4	5	4	5	0	5	65
Conflicts	3	5	2	3	1	0	5	4	5	0	4	2	5	4	5	0	3	51
Land uses	4	5	5	5	5	0	2	5	3	0	5	2	5	4	3	0	3	56
Land tenure	2	5	3	0	2	0	3	2	3	0	2	2	5	3	0	0	3	35
Economic resources	4	5	5	5	5	0	4	5	5	0	5	4	5	4	5	0	3	64
Educational programs	5	5	5	5	5	0	5	5	5	0	5	5	5	5	5	0	5	70
Extension programs	5	5	5	5	5	0	5	5	5	0	5	5	5	5	5	0	5	70
Totals:	26	35	30	28	28	0	29	31	30	0	31	24	35	29	28	0	27	411
TOTALS	78	77	84	58	51	0	40	88	59	0	58	36	85	62	94	0	57	927

Table 3.15. Environmental impact matrix produced for Pedra Roxa community, National Park of Caparaó.

National Park:	Caparaó								Locality: Pedra Roxa									
	Human Activities																	
Environmental Components	Cattle raisin	Fire	Agriculture	Pesticides	Fertilizers	Hunting	Poaching	Reforesting	Mining	Settlement	Roads	Tourism	Extractivism	Timber	Fisherie	Charcoal	Firewood	TOTALS
Water:																		
Turbidity	1	0	1	0	0	0	0	2	2	0	1	0	1	1	1	0	1	11
Chemical pollution	0	0	0	3	0	0	0	2	0	0	0	0	0	0	1	0	0	6
Silted watercourses	0	0	0	0	1	0	0	2	2	0	2	0	0	0	1	0	1	9
Increased demand	0	0	0	0	0	0	0	3	0	0	0	0	0	0	3	0	0	6
Totals:	1	0	1	3	1	0	0	9	4	0	3	0	1	1	6	0	2	32
Air:																		
Chemical pollution	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dust	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Smoke	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Totals:	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Soils:																		
Erosion	1	0	3	0	0	0	0	3	2	0	2	0	1	1	1	0	1	15
Compacting	2	0	2	0	0	0	0	1	0	0	3	0	0	0	0	0	0	8
Chemical pollution	3	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	7
Nutrient losses	3	0	4	0	0	0	0	3	0	0	1	0	2	1	2	0	2	18
Increased salts	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
Totals:	9	0	10	3	3	0	0	7	2	0	6	0	3	2	3	0	3	51
Wildlife:																		
Populational decreases	0	1	0	2	0	0	4	0	0	0	1	0	0	0	0	0	0	8
Habitat losses	2	2	2	2	2	0	0	2	1	0	1	0	1	1	2	0	1	19
Habitat alterations	3	3	3	3	3	0	0	3	2	0	2	0	2	2	2	0	2	30
Exotic species	4	0	0	0	0	0	0	3	0	0	0	0	0	0	3	0	0	10
Inadequate food supply	2	3	3	2	0	0	0	3	0	0	1	0	2	2	0	0	1	19
Inadequate water supply	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	2
Intoxication	0	2	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	5
Totals:	11	11	8	13	5	0	4	11	3	0	6	0	5	5	7	0	4	93
Vegetation:																		
Populational decreases	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2
Habitat alterations	3	2	3	2	2	0	0	3	2	0	2	0	2	2	0	0	1	24
Biomass reduction	3	3	2	3	3	0	0	3	1	0	1	0	3	2	0	0	1	25
Vegetation cover reduct	3	3	3	3	3	0	0	3	1	0	2	0	3	2	0	0	1	27
Exotic species	3	0	5	0	3	0	0	4	0	0	1	0	0	0	0	0	0	16
Chemical damage	4	0	1	3	0	0	0	1	0	0	0	0	0	0	0	0	0	9
Totals:	16	8	14	11	11	0	0	14	4	0	6	0	10	6	0	0	3	103
Scenic resources:																		
Geological features	3	2	2	2	0	0	0	3	4	0	2	0	2	1	0	0	1	22
Scenic view	3	3	2	3	0	0	0	2	3	0	3	0	3	1	0	0	0	23
Landscape	4	2	3	2	0	0	0	2	2	0	2	0	1	2	0	0	0	20
Totals:	10	7	7	7	0	0	0	7	9	0	7	0	6	4	0	0	1	65
Culture:																		
Cultural monuments	2	0	1	0	0	0	0	0	0	0	2	0	5	2	0	0	0	12
Cultural buildings	4	3	4	0	2	0	0	3	0	0	3	0	5	1	0	0	2	27
Cultural heritage	5	5	5	3	4	0	4	4	4	0	4	0	5	5	3	0	5	56
Ethnobiological resource	1	2	1	1	1	0	3	2	1	0	2	0	1	2	2	0	2	21
Totals:	12	10	11	4	7	0	7	9	5	0	11	0	16	10	5	0	9	116
Socio-economic resources:																		
Local attitudes	5	5	5	5	5	0	4	4	4	0	5	0	5	5	3	0	5	60
Conflicts	4	5	3	3	1	0	5	3	5	0	4	0	5	5	1	0	3	47
Land uses	4	5	5	5	5	0	1	4	4	0	4	0	3	3	2	0	3	48
Land tenure	5	5	5	0	1	0	2	2	1	0	2	0	5	2	2	0	2	34
Economic resources	4	5	5	4	5	0	5	5	5	0	5	0	5	5	1	0	5	59
Educational programs	5	5	5	5	5	0	5	5	5	0	5	0	5	5	4	0	5	64
Extension programs	5	5	5	5	5	0	5	5	5	0	5	0	5	5	4	0	5	64
Totals:	32	35	33	27	27	0	27	28	29	0	30	0	33	30	17	0	28	376
TOTALS	91	74	84	68	54	0	38	85	56	0	69	0	74	58	38	0	50	839

Table 3.16. Environmental impact matrix produced for Chapada Gaúcha community, National Park of Grandes Sertões Vereda.

National Park:	Grandes Sertões Vereda						Locality: Chapada Gaucha											
	Human Activities																	
Environmental Components	Cattle raisin	Fire	Agriculture	Pesticides	Fertilizers	Hunting	Poaching	Reforesting	Mining	Settlement	Roads	Tourism	Extractivism	Timber	Fisherie	Charcoal	Firewood	TOTALS
Water:																		
Turbidity	0	0	0	4	2	0	0	0	0	1	2	0	0	0	2	1	0	12
Chemical pollution	0	0	0	5	1	0	0	0	0	2	0	0	0	0	1	0	0	9
Silted watercourses	0	0	0	0	0	0	0	0	0	2	2	0	0	0	1	0	0	5
Increased demand	1	0	4	5	2	0	0	2	0	5	0	0	0	0	2	2	0	23
Totals:	1	0	4	14	5	0	0	2	0	10	4	0	0	0	6	3	0	49
Air:																		
Chemical pollution	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Dust	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Smoke	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	6
Totals:	0	3	3	3	0	0	0	0	0	0	0	0	0	0	0	3	0	12
Soils:																		
Erosion	1	0	4	2	2	0	0	0	0	3	2	0	0	1	2	3	1	21
Compacting	2	0	4	2	0	0	0	0	0	4	2	0	0	0	0	1	0	15
Chemical pollution	0	0	0	5	0	0	0	0	0	2	0	0	0	0	0	0	0	7
Nutrient losses	2	0	4	1	0	0	0	2	0	2	2	0	0	1	0	4	2	20
Increased salts	0	0	2	0	5	0	0	0	0	0	0	0	0	0	0	0	0	7
Totals:	5	0	14	10	7	0	0	2	0	11	6	0	0	2	2	8	3	70
Wildlife:																		
Populational decreases	0	2	0	4	0	0	0	0	0	2	2	0	0	2	0	0	2	14
Habitat losses	2	3	3	4	0	0	0	1	0	3	1	0	0	1	0	3	1	22
Habitat alterations	3	3	4	5	5	0	0	2	0	4	3	0	0	0	0	4	2	35
Exotic species	3	0	0	0	0	0	0	0	0	5	1	0	0	4	0	0	0	13
Inadequate food supply	2	3	4	5	1	0	0	2	0	5	2	0	0	1	0	4	2	31
Inadequate water supply	1	0	2	4	0	0	0	1	0	3	1	0	0	0	0	1	2	15
Intoxication	0	2	0	5	1	0	0	0	0	2	0	0	0	0	0	3	0	13
Totals:	11	13	13	27	7	0	0	6	0	24	10	0	0	8	0	15	9	143
Vegetation:																		
Populational decreases	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Habitat alterations	3	2	4	4	0	0	0	2	0	5	2	0	0	1	0	4	1	28
Biomass reduction	2	3	4	5	0	0	0	2	0	4	2	0	0	1	0	4	2	29
Vegetation cover reduct	2	3	4	4	0	0	0	2	0	4	2	0	0	1	0	4	2	28
Exotic species	2	0	5	0	0	0	0	3	0	5	0	0	0	0	0	0	0	15
Chemical damage	0	0	4	5	1	0	0	0	0	1	0	0	0	0	0	1	0	12
Totals:	9	8	21	18	1	0	0	9	0	19	6	0	0	3	0	13	5	112
Scenic resources:																		
Geological features	1	1	1	2	2	0	0	1	0	4	2	0	0	1	0	4	1	20
Scenic view	1	2	3	2	2	0	0	1	0	5	2	0	0	1	0	3	1	23
Landscape	1	2	3	3	2	0	0	1	0	4	2	0	0	1	0	4	1	24
Totals:	3	5	7	7	6	0	0	3	0	13	6	0	0	3	0	11	3	67
Culture:																		
Cultural monuments	0	2	2	0	0	0	0	1	0	1	2	0	0	2	0	3	1	14
Cultural buildings	1	3	2	2	2	0	0	2	0	4	3	0	0	3	0	4	2	28
Cultural heritage	2	4	5	5	4	0	0	3	0	5	5	0	0	3	3	5	4	48
Ethnobiological resource	1	2	2	2	2	0	0	2	0	3	1	0	0	0	0	2	2	19
Totals:	4	11	11	9	8	0	0	8	0	13	11	0	0	8	3	14	9	109
Socio-economic resources:																		
Local attitudes	5	5	5	5	5	0	0	3	0	5	5	0	0	2	4	5	4	53
Conflicts	2	3	3	5	3	0	0	2	0	4	3	0	0	1	2	5	3	36
Land uses	5	5	5	5	5	0	0	3	0	4	5	0	0	2	2	5	4	50
Land tenure	3	2	5	2	2	0	0	3	0	5	5	0	0	2	5	4	3	41
Economic resources	5	5	5	5	5	0	0	3	0	5	5	0	0	2	4	3	5	52
Educational programs	5	5	5	5	5	0	0	3	0	5	5	0	0	5	4	5	5	57
Extension programs	5	5	5	5	5	0	0	3	0	5	5	0	0	5	5	5	5	58
Totals:	30	30	33	32	30	0	0	20	0	33	33	0	0	19	5	32	29	347
TOTALS	63	70	106	120	64	0	0	50	0	123	76	0	0	43	16	99	58	888

Table 3.19. Overall environmental impact matrix produced for the National Park of Serra da Canastra.

National Park:	Serra da Canastra						Locality: Overall averages										
	Human Activities																
Environmental Components	Cattle raisin	Fire	Agriculture	Pesticides	Fertilizers	Hunting	Poaching	Reforesting	Mining	Settlement	Roads	Tourism	Extractivism	Timber	Fisherie	Charcoal	Firewood	TOTALS
Water:																		
Turbidity	1	0	1.3	1	1	0	0	0	1.7	0	1	0	0	1.3	0	0	1	9.3
Chemical pollution	0	0	0	2	0	0	0	0	1.7	0	0	0	0	0	0	0	0	3.7
Silted watercourses	0.3	0	0.3	0	0.7	0	0	0	1.7	0	0.7	0	0	0.3	0	0	0	4.0
Increased demand	1.3	0.3	0	1	0	0	0	1.7	1.7	0	0	0	0	0	0	0	0	6.0
Totals:	2.7	0.3	1.7	4	1.7	0	0	1.7	6.7	0	1.7	0	0	1.7	0	0	1	23.0
Air:																		
Chemical pollution	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Dust	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Smoke	0	1.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.7
Totals:	0	1.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.7
Soils:																		
Erosion	1.7	0	2	0	0	0	0	0	1.7	0	1	0.3	0	1	0	0	1.3	9.0
Compacting	2.7	0	1	0	0	0	0	0	0.7	0	2.3	0.7	0	0	0	0	0	7.3
Chemical pollution	0	0	0.3	1.7	0.3	0	0	0	1.7	0	0	0	0	0	0	0	0	4.0
Nutrient losses	2.7	0	3.3	0	0	0	0	2.7	1.7	0	1	0.3	0	2	0	0	2.3	16.0
Increased salts	0	0	0.7	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3.7
Totals:	7	0	7.3	1.7	3.3	0	0	2.7	5.7	0	4.3	1.3	0	3	0	0	3.7	40.0
Wildlife:																		
Populational decreases	0	2	0	1.3	0	0	0	0	1.3	0	1.3	0.3	0	0	0	0	0	6.3
Habitat losses	2.3	2	2	1.3	0	0	0	2.3	1.3	0	1	0	0	1.3	0	0	1.3	15.0
Habitat alterations	3	2.7	2.7	2	2.3	0	0	2.7	1.7	0	1.3	0.7	0	2	0	0	1.3	22.3
Exotic species	4.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.3	4.7
Inadequate food supply	2.3	2.7	2.3	2	0.3	0	0	2.7	1.7	0	0.3	0	0	1.7	0	0	1.7	17.7
Inadequate water supply	0	0	0	1.7	0	0	0	0	1.7	0	0	0	0	0	0	0	0	3.3
Intoxication	0	1.3	0	2	0	0	0	0	1.7	0	0	0	0	0	0	0	0	5.0
Totals:	12	11	7	10	2.7	0	0	7.7	9.3	0	4	1	0	5	0	0	4.7	74.3
Vegetation:																		
Populational decreases	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.3
Habitat alterations	2.7	2	2.3	2	1	0	0	2.3	1.3	0	1	0.3	0	1.3	0	0	1	17.3
Biomass reduction	2.7	3	3	2	0	0	0	0	1.3	0	1	0.3	0	2.7	0	0	2	18.0
Vegetation cover reducti	2.7	3	3	1.7	0	0	0	0	1.3	0	1	0	0	2.7	0	0	2	17.3
Exotic species	2.7	0	4.3	0	1	0	0	3	0	0	0	0.3	0	0	0	0	0	11.3
Chemical damage	0	0	0	2	0	0	0	0	1.7	0	0	0	0	0	0	0	0	3.7
Totals:	11	8	13	7.7	2	0	0	5.3	5.7	0	3	1	0	6.7	0	0	5	68.0
Scenic resources:																		
Geological features	1.7	1	2	0	0.7	0	0	1	1.7	0	1.3	0.3	0	1.3	0	0	0.3	11.3
Scenic view	2.3	2	2.3	0	0	0	0	1.7	1.7	0	1.3	0	0	1	0	0	0.7	13.0
Landscape	2.7	2	3.3	0	0	0	0	2	1.7	0	1.3	0	0	1	0	0	0.3	14.3
Totals:	6.7	5	7.7	0	0.7	0	0	4.7	5	0	4	0.3	0	3.3	0	0	1.3	38.7
Culture:																		
Cultural monuments	0.7	2	0.3	0	0	0	0	0	0	0	1	1.7	0	0.3	0	0	0	6.0
Cultural buildings	4	2.7	3.7	0	0	0	0	0.7	0	0	0.3	1	0	2.7	0	0	1.3	16.3
Cultural heritage	5	5	4.7	3	3	0	0	3.7	1.7	0	3.3	1.7	0	3	0	0	4.7	38.7
Ethnobiological resources	2.3	2.3	2.3	2	0.7	0	0	1.3	0.7	0	1.3	0.7	0	1.3	0	0	1.7	16.7
Totals:	12	12	11	5	3.7	0	0	5.7	2.3	0	6	5	0	7.3	0	0	7.7	77.7
Socio-economic resources:																		
Local attitudes	5	5	4.7	2.7	2.7	0	0	2.7	1.7	0	3.7	2.7	0	3.3	0	0	4.7	38.7
Conflicts	3.3	4.3	3	2.3	0.3	0	0	0.7	1.7	0	3	1.7	0	3.7	0	0	2.7	26.7
Land uses	4.7	4.7	5	4.7	4.7	0	0	4	1.7	0	4.7	2	0	3	0	0	3.7	42.7
Land tenure	2.7	2.7	1.7	1	0	0	0	0.7	0.7	0	1	0	0	1.3	0	0	1	12.7
Economic resources	5	5	5	5	5	0	0	3.3	1.7	0	5	3	0	3.7	0	0	3	44.7
Educational programs	5	5	5	5	5	0	0	5	1.7	0	3.3	3.3	0	5	0	0	5	48.3
Extension programs	5	4.7	5	5	5	0	0	5	1.7	0	5	3.3	0	5	0	0	5	49.7
Totals:	31	31	29	26	23	0	0	21	11	0	26	16	0	25	0	0	25	263.3
TOTALS	82	69	77	54	37	0	0	49	45	0	49	25	0	52	0	0	48	586.7

Table 3.20. Overall environmental impact matrix produced for the National Park of Serra do Cipó.

National Park:	Serra do Cipó											Locality: Overall averages							
	Human Activities																		
Environmental Components	Cattle raisin	Fire	Agriculture	Pesticides	Fertilizers	Hunting	Poaching	Reforesting	Mining	Settlement	Roads	Tourism	Extractivism	Timber	Fisherie	Charcoal	Firewood	TOTALS
Water:																		
Turbidity	0.7	0.3	0.7	0	0	0	0	0	0	0	1.3	1.3	1	0.7	0	0	0.7	6.7
Chemical pollution	0	0	0.3	0.7	0	0	0	0	0	0	0	2.3	0.7	0	0	0	0	4.0
Silted watercourses	0	0	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.3
Increased demand	1	0	0.7	0.3	0	0	0	0	0	0	0	1.7	0	0	0	0	0	3.7
Totals:	1.7	0.3	2	1	0	0	0	0	0	0	1.3	5.3	1.7	0.7	0	0	0.7	14.7
Air:																		
Chemical pollution	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Dust	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Smoke	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.0
Totals:	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.0
Soils:																		
Erosion	1	0	2	0	0	0	0	0	0	0	1.3	1	1.3	1.3	0	0	1	9.0
Compacting	2	0.3	1	0	0	0	0	0	0	0	2	1.7	0	0	0	0	0	7.0
Chemical pollution	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1.0
Nutrient losses	1.3	0	2.3	0	0	0	0	0	0	0	0.7	0.3	1.7	1.7	0	0	1.3	9.3
Increased salts	0	0	0	0	1.7	0	0	0	0	0	0	0	0	0	0	0	0	1.7
Totals:	4.3	0.3	5.3	1	1.7	0	0	0	0	0	4	3	3	3	0	0	2.3	28.0
Wildlife:																		
Populational decreases	0	1.7	0	0.7	0	0	0	0	0	0	0.7	0	0.3	0.3	0	0	0	3.7
Habitat losses	1	2	1.7	0.7	0.3	0	0	0	0	0	0.3	1	1	1.3	0	0	1	10.3
Habitat alterations	1.7	2.7	2.7	1	0.7	0	0	0	0	0	1.7	1.7	1.7	1.7	0	0	1.3	16.7
Exotic species	3	0	0	0	0	0	0	0	0	0	0	1.3	0.3	0	0	0	0.3	5.0
Inadequate food supply	2.3	1.3	1.7	0.7	0.7	0	0	0	0	0	0.3	0.7	2	1.7	0	0	1.7	13.0
Inadequate water supply	0	0.3	0	1.3	0	0	0	0	0	0	0	1	0.7	0	0	0	0	3.3
Intoxication	0	1.3	0	1.3	0	0	0	0	0	0	0	0	0	0	0	0	0	2.7
Totals:	8	9.3	6	5.7	1.7	0	0	0	0	0	3	5.7	6	5	0	0	4.3	54.7
Vegetation:																		
Populational decreases	0.3	0	0	0	0	0	0	0	0	0	0	0	0.3	0.3	0	0	0	1.0
Habitat alterations	2	2	2	0.7	0.3	0.7	0	0	0	0	0.7	1.3	1.7	2	0	0	1.3	14.7
Biomass reduction	2.3	2.3	2.3	1	0.7	0	0	0	0	0	0.7	1.3	2.3	2.3	0	0	2	17.3
Vegetation cover reducti	2.3	2.3	2.3	1	0	0	0	0	0	0	1	1.7	1.7	2	0.7	0	1.7	16.7
Exotic species	2.3	0	3	0.3	0	0	0	0	0	0	0	2.7	0.3	0.7	0	0	0.7	10.0
Chemical damage	0	0	0	0.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0.7
Totals:	9.3	6.7	9.7	3.7	1	0.7	0	0	0	0	2.3	7	6.3	7.3	0.7	0	5.7	60.3
Scenic resources:																		
Geological features	1.7	2	1	0.3	0	0	0	0	0	0	1	1.3	1	1	0	0	1	10.3
Scenic view	1	1.7	1.3	0.3	0	0	0	0	0	0	1	1.3	0.7	1	0	0	0.7	9.0
Landscape	1	1.7	1.3	0.3	0	0	0	0	0	0	1	1.7	1	1	0	0	0.7	9.7
Totals:	3.7	5.3	3.7	1	0	0	0	0	0	0	3	4.3	2.7	3	0	0	2.3	29.0
Culture:																		
Cultural monuments	0.3	1.7	0.3	1	0	0	0	0	0	0	0.7	2.7	0	0.7	0	0	0	7.3
Cultural buildings	1.3	2.3	2.3	1.7	0.7	0.7	0	0	0	0	1.3	2.3	0	0.7	0	0	0.7	14.0
Cultural heritage	3	3.3	4	0	0.7	0.7	0	0	0	0	3	2.3	3	3	0	0	3	26.0
Ethnobiological resources	1.7	1.7	3	0	0.3	0.7	0	0	0	0	1.7	2.3	3	3.3	0	0	3.3	21.0
Totals:	6.3	9	9.7	2.7	1.7	2	0	0	0	0	6.7	9.7	6	7.7	0	0	7	68.3
Socio-economic resources:																		
Local attitudes	3	4	4.3	3	2.3	0	0	0	0	0	3.3	4.3	2.7	3.3	0	0	3.3	33.7
Conflicts	3.7	4.7	3.3	2.7	1.3	0	0	0	0	0	3	3	3.7	4.3	0	0	4	33.7
Land uses	4	3.3	4.3	2.3	2.3	0	0	0	0	0	3	2	2.3	3	0	0	3.3	30.0
Land tenure	2.7	3	2.7	1.3	1.7	0	0	0	0	0	1.3	1.3	3.3	2.7	0	0	3	23.0
Economic resources	4	4	4	3	3	0	0	0	0	0	3	3	4.3	3.7	0	0	3.7	35.7
Educational programs	4	5	4.3	3.3	3.3	0	0	0	0	0	3.3	4	4.3	4.3	0	0	4.7	40.7
Extension programs	5	5	5	3.3	3.3	0	0	0	0	0	3.7	4.7	4.7	4.7	0	0	5	44.3
Totals:	26	29	28	19	17	0	0	0	0	0	21	22	25	26	0	0	27	241.0
TOTALS	60	62	64	34	23	2.7	0	0	0	0	41	57	51	53	0.7	0	49	498.0

Table 3.21. Overall environmental impact matrix produced for the National Park of Caparaó.

National Park:	Caparaó							Locality: Overall averages										
	Human Activities																	
Environmental Components	Cattle raisin	Fire	Agriculture	Pesticides	Fertilizers	Hunting	Poaching	Reforesting	Mining	Settlement	Roads	Tourism	Extractivism	Timber	Fisherie	Charcoal	Firewood	TOTALS
Water:																		
Turbidity	1	0	1	0.7	0.3	0	0	1.3	1	0	0.7	0.3	1	0.7	1	0	0.7	9.7
Chemical pollution	0	0	0.3	1.7	0	0	0	1.3	0	0	0	0.3	0	0	1.3	0	0	5.0
Silted watercourses	0	0	0.3	0.3	0.3	0	0	1.3	1.3	0	1.3	0.3	0.7	0.3	1.3	0	0.7	8.3
Increased demand	1	0	0	0	0.7	0	0	3	0	0	0	1.3	0	0	2.7	0	0	8.7
Totals:	2	0	1.7	2.7	1.3	0	0	7	2.3	0	2	2.3	1.7	1	6.3	0	1.3	31.7
Air:																		
Chemical pollution	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Dust	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Smoke	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.0
Totals:	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.0
Soils:																		
Erosion	1	0	2.7	0	0	0	0	2.3	1.7	0	1.7	0.7	1	1.3	1.3	0	1	14.7
Compacting	2.3	0	2	0	0	0	0	1	0	0	2.3	0.7	0	0.3	0.7	0	0	9.3
Chemical pollution	1	0	1.3	2.3	0	0	0	0.3	0	0	0	0	0	0	0	0	0	5.0
Nutrient losses	2.7	0	4.3	0	0	0	0	3	0	0	1.3	0.7	1.7	2	1.3	0	2	19.0
Increased salts	0	0	0	0	3.7	0	0	1	0	0	0	0	0	0	0	0	0	4.7
Totals:	7	0	10	2.3	3.7	0	0	7.7	1.7	0	5.3	2	2.7	3.7	3.3	0	3	52.7
Wildlife:																		
Populational decreases	0	1.7	0	1	0	0	2.7	0	0	0	1	0	0	0	0.7	0	0	7.0
Habitat losses	2	2.7	2	1	1	0	0	2	0.7	0	1	0.7	1	1	1.3	0	1	17.3
Habitat alterations	3	3.7	3.3	2.3	3	0	0	3	1.3	0	2	1	1.7	1.7	1.3	0	1.7	29.0
Exotic species	4.3	0	1	0	0	0	0	1	0	0	0	0	0	0	2.7	0	0	9.0
Inadequate food supply	2.3	3.7	3.3	1.7	0.3	0	0	2.7	0	0	1	0	1.7	1.3	0.7	0	0.7	19.3
Inadequate water supply	0.3	1	0.3	0.7	0	0	0	0	0	0	0.3	0	0	0	1	0	0	3.7
Intoxication	0	2.3	0	2.3	0	0	0	0.3	0	0	0	0	0	0	0.7	0	0	5.7
Totals:	12	15	10	9	4.3	0	2.7	9	2	0	5.3	1.7	4.3	4	8.3	0	3.3	91.0
Vegetation:																		
Populational decreases	0	0	0	1	0	0	0	0	0	0	0	0	1.3	0	0	0	0	2.3
Habitat alterations	2.7	2.3	3.3	2	2.7	0	0	3	1.7	0	1.3	0.3	1.7	1.7	1	0	1.3	25.0
Biomass reduction	3.3	3.3	2.7	2.7	1	0	0	1.7	1	0	1	0.3	2	2	1	0	1.7	23.7
Vegetation cover reducti	3.7	3.3	3	2.7	1	0	0	1.7	1	0	1.3	0.7	2	2	0.7	0	1.3	24.3
Exotic species	3.7	0	4	0	1.7	0	0	4.3	0	0	0.3	1	0	0	0.7	0	1	16.7
Chemical damage	3	0.7	0.7	2	0	0	0	0.7	0	0	0	0	0	0	0	0	0.3	7.3
Totals:	16	9.7	14	10	6.3	0	0	11	3.7	0	4	2.3	7	5.7	3.3	0	5.7	99.3
Scenic resources:																		
Geological features	1.7	1.7	2.3	1.3	0.7	0	0	2	3	0	1.7	0.3	1.3	1.3	1	0	1.3	19.7
Scenic view	2.3	2.3	2.3	1.7	0.7	0	0	1.3	1.7	0	1.7	0.7	1.7	1	0.7	0	0.7	18.7
Landscape	3	1.7	2.7	1.3	0.7	0	0	2	1.3	0	1.7	0.3	1	1.7	1	0	0.7	19.0
Totals:	7	5.7	7.3	4.3	2	0	0	5.3	6	0	5	1.3	4	4	2.7	0	2.7	57.3
Culture:																		
Cultural monuments	2.3	2	1.7	0	0.3	0	0	1	0	0	1.7	1.3	2.7	2.3	1.3	0	1	17.7
Cultural buildings	3	3.3	4	0	3.3	0	0	2.7	0	0	2	1.7	3.3	2	0.7	0	1.3	27.3
Cultural heritage	4	4.7	5	3.7	4.7	0	2.7	4	2.3	0	4	3.3	3.3	4.7	2.3	0	4.7	53.3
Ethnobiological resources	1.7	2	1.7	1.3	1	0	2	1.3	0.7	0	1.3	1.7	1.3	1.7	0.7	0	2	20.3
Totals:	11	12	12	5	9.3	0	4.7	9	3	0	9	8	11	11	5	0	9	118.7
Socio-economic resources:																		
Local attitudes	4	5	5	5	5	0	3	4	2.7	0	5	3	3.3	4	2.7	0	4.3	56.0
Conflicts	3.7	5	2.7	3	1.3	0	3.3	3	3.3	0	3.3	2	3.3	3.7	2	0	3	42.7
Land uses	4.3	4.7	5	5	5	0	1	4	2.3	0	4.7	2	2.7	3.3	1.7	0	3	48.7
Land tenure	4	5	4.3	0.3	2	0	1.7	1.7	1.3	0	2.3	1.3	3.3	2.7	0.7	0	2.3	33.0
Economic resources	4	5	5	4.7	5	0	3	4.3	3.3	0	5	3	3.3	4	2	0	4.3	56.0
Educational programs	5	5	5	5	5	0	3.3	5	3.3	0	5	3.3	3.3	5	3	0	5	61.3
Extension programs	5	5	5	5	5	0	3.3	5	3.3	0	5	3.3	3.3	5	3	0	5	61.3
Totals:	30	35	32	28	28	0	19	27	20	0	30	18	23	28	15	0	27	359.0
TOTALS	85	80	87	62	55	0	26	76	38	0	61	36	53	57	44	0	52	812.7

Table 3.22. Overall environmental impact matrix produced for the National Park of Grandes Sertões Vereda.

National Park:	Grandes Sertões Vereda								Locality: Overall averages									
	Human Activities																	
Environmental Components	Cattle raisir	Fire	Agriculture	Pesticides	Fertilizers	Hunting	Poaching	Reforesting	Mining	Settlement	Roads	Tourism	Extractivism	Timber	Fisherie	Charcoal	Firewood	TOTALS
Water:																		
Turbidity	0.7	0	1	2	1	0	0	0	0	1	1.3	0	0.7	0.3	0.7	0.3	1	10.0
Chemical pollution	0	0	0	2	0.7	0	0	0	0	1.7	0	0	0	0	0.3	0	0	4.7
Silted watercourses	0.3	0	1	0	0	0	0	0	0	1.3	1.7	0	1	0.3	0.3	0	0	6.0
Increased demand	0.7	0	1.3	1.7	0.7	0	0	0.7	0	2.3	0	0	0	0	0.7	0.7	0	8.7
Totals:	1.7	0	3.3	5.7	2.3	0	0	0.7	0	6.3	3	0	1.7	0.7	2	1	1	29.3
Air:																		
Chemical pollution	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1.0
Dust	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.0
Smoke	0	2.7	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	3.7
Totals:	0	2.7	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	5.7
Soils:																		
Erosion	0.7	0	2.7	0.7	1	0	0	0	0	2	2.3	0	1.3	1	0.7	1	1.3	14.7
Compacting	1.7	0	1.3	0.7	0	0	0	0	0	2.3	2.3	0	0.3	0	0	0.3	0	9.0
Chemical pollution	0	0	0	2.3	0	0	0	0	0	1.7	0	0	0	0	0	0	0	4.0
Nutrient losses	1.7	0	3	0.3	0	0	0	0.7	0	1.3	2	0	1.3	1.3	0	1.3	2	15.0
Increased salts	0	0	0.7	0	2.3	0	0	0	0	0.7	0	0	0	0	0	0	0	3.7
Totals:	4	0	7.7	4	3.3	0	0	0.7	0	8	6.7	0	3	2.3	0.7	2.7	3.3	46.3
Wildlife:																		
Populational decreases	0	1.3	0	1.7	0	0	0	0	0	1	1.3	0	0	0.7	0	0	0.7	6.7
Habitat losses	1	2	1.7	1.3	0	0	0	0.3	0	2	1.3	0	1	1	0	1	1	13.7
Habitat alterations	1.7	2.3	2.7	2	2	0	0	0.7	0	2.7	2.3	0	1.3	0.7	0	1.3	1.7	21.3
Exotic species	2.7	0	0	0	0	0	0	0	0	2.3	0.3	0	0	1.7	0	0	0	7.0
Inadequate food supply	1.7	2.3	1.7	2	0.3	0	0	0.7	0	2.3	1.3	0	1	1	0	1.3	1.7	17.3
Inadequate water supply	0.3	0	0.7	1.7	0	0	0	0.3	0	1.3	0.3	0	0.3	0.3	0	0.3	0.7	6.3
Intoxication	0	0.7	0	1.7	0.3	0	0	0	0	1.7	0	0	0	0	0	1	0	5.3
Totals:	7.3	8.7	6.7	10	2.7	0	0	2	0	13	7	0	3.7	5.3	0	5	5.7	77.7
Vegetation:																		
Populational decreases	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Habitat alterations	1.7	1.7	2.3	1.7	0.3	0	0	0.7	0	2.7	2	0	1.3	1	0	1.3	1	17.7
Biomass reduction	1.7	2.3	2.7	2	0	0	0	0.7	0	2.3	2	0	1.7	1	0	1.3	1.7	19.3
Vegetation cover reducti	1.3	2	2.3	1.7	0	0	0	0.7	0	2.3	2	0	1.3	1	0	1.3	1.7	17.7
Exotic species	0.7	0	3.3	0	0	0	0	1	0	2.3	0	0	0	0	0	0	0.3	7.7
Chemical damage	0	0	1.3	1.7	0.3	0	0	0	0	1	0	0	0	0	0	0.3	0	4.7
Totals:	5.3	6	12	7	0.7	0	0	3	0	11	6	0	4.3	3	0	4.3	4.7	67.0
Scenic resources:																		
Geological features	0.3	1	0.3	0.7	0.7	0	0	0.3	0	2	1.7	0	0.7	0.7	0	1.3	0.3	10.0
Scenic view	0.7	1.3	1.3	0.7	0.7	0	0	0.3	0	2.3	1.3	0	1	1	0	1	0.3	12.0
Landscape	0.3	1.3	1.3	1	0.7	0	0	0.3	0	2	1.7	0	1	0.7	0	1.3	0.3	12.0
Totals:	1.3	3.7	3	2.3	2	0	0	1	0	6.3	4.7	0	2.7	2.3	0	3.7	1	34.0
Culture:																		
Cultural monuments	0	0.7	1.3	0	0	0	0	0.3	0	0.3	1	0	2	3	0	1	0.3	10.0
Cultural buildings	0.7	4.3	2	0.7	0.7	0	0	0.7	0	2.3	1.7	0	3.3	4.3	0	1.3	0.7	22.7
Cultural heritage	3.3	4.7	5	2.3	2	0	0	1	0	3.3	4.3	0	3.3	4.3	1	1.7	3	39.3
Ethnobiological resources	0.7	1.7	2.3	1	1	0	0	0.7	0	1.7	1	0	3.3	3.3	0	0.7	1.3	18.7
Totals:	4.7	11	11	4	3.7	0	0	2.7	0	7.7	8	0	12	15	1	4.7	5.3	90.7
Socio-economic resources:																		
Local attitudes	5	5	5	3.3	2.7	0	0	1	0	3	4.7	0	3.3	3.3	1.3	1.7	4.7	44.0
Conflicts	2	3	3.3	3.3	1.7	0	0	0.7	0	3	4.3	0	2	3	0.7	1.7	3	31.7
Land uses	5	5	5	3.3	2.7	0	0	1	0	2.7	4	0	2.7	3	0.7	1.7	4.7	41.3
Land tenure	4.3	3	4	2.3	2.3	0	0	1	0	3.3	5	0	1.3	4	1.7	1.3	3.7	37.3
Economic resources	5	5	5	3.3	3.3	0	0	1	0	3.3	4	0	3.3	4	1.3	1	4.3	44.0
Educational programs	5	5	5	3.3	3.3	0	0	1	0	3.3	5	0	3.3	5	1.3	1.7	4.3	46.7
Extension programs	5	5	5	3.3	3.3	0	0	1	0	3.3	5.3	0	3.3	5	1.7	1.7	5	48.0
Totals:	31	31	32	22	19	0	0	6.7	0	22	32	0	19	27	8.7	11	30	293.0
TOTALS	56	63	77	57	34	0	0	17	0	74	68	0	47	56	12	33	51	643.7